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Overmyer, LaVahn

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This report has two main purposes: (1) To give an account of the use of automation in selected libraries throughout the country and in the development of networks; and (2) To discuss some of the fundamental considerations relevant to automation and the implications for library education, library research and the library profession. The first part of the report traces the development of automation in libraries and discusses in detail the work going on in more than twenty selected libraries. In addition, briefer accounts are given for a number of other libraries and cooperative projects. The second part is concerned with factors that must be taken into account in planning and developing automated systems and networks and the implications of automation for library education, library research, and the library profession. (Author)

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HEALTH, EDUCATION, AND WELFARE

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LIBRARY AUTOMATION: A CRITICAL REVIEW

By

LaVahn Overmyer
Case Western Reserve University
Cleveland, Ohio

December 1969

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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Bureau of Research

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PREFACE

During the Fall Semester of 1967-1968 I was granted a Sabbatical Leave for the purpose of gathering data on the progress of automation in libraries. With financial assistance from the U. S. Office of Education, I was able to travel from coast to coast to observe first hand the work going on in about fifty libraries of this country. It was a most enlightening experience. The opportunity to participate in the MARC Project at the Library of Congress for two months was especially helpful before visiting the other libraries.

I am deeply indebted to the many librarians who interrupted their busy days and gave me so many hours of their time with patience and understanding. I am also grateful to Dean Jesse H. Shera and the Administration of Case Western Reserve University for granting the leave. Last but by no means least I appreciate the encouragement of Dean A. J. Goldwyn and the quality of forbearance exhibited by the faculty of the School of Library Science and my colleagues at the Center for Documentation and Communication Research.

While this report attempts to reflect the opinions of a sizable number of librarians, the statements expressed are my own.

LaVahn Overmyer

SUMMARY

This is a report on the use of data processing equipment in libraries, often called "library automation." Data processing devices, first punched card equipment and now computers, have been used in libraries for the last twenty-five years. The greatest growth, however, has come about within the last ten years during which time computers have become an important factor in American business, industry, and government and have had a decided effect on the American economy.

In the beginning the equipment was used in libraries primarily as a labor-saving device to speed up processing by making catalog cards, book catalogs, and listings, by handling orders and circulation control, and by performing other tasks considered housekeeping routines.

Today there are more than one thousand libraries--academic, public, special--involved at different stages and degrees of development in the use of data processing equipment for handling much of the work in acquisitions, bibliographic control, and circulation. Furthermore, there is very active involvement by an increasing number of libraries in the development of centralized processing centers and reference service networks.

Libraries are changing in many ways, but to say that automation has been the cause is to oversimplify a very complex situation. After World War II, in particular, libraries were faced with an increasing number of problems. Established libraries were growing rapidly and budgets were being strained. Libraries were finding it ever more difficult to keep up with the day-to-day processing of an influx of new materials and to control properly their existing collections. But most important of all, the demand for the expansion of library services was forcing libraries to take a new look at themselves. The number of library patrons was increasing rapidly and on the whole they were better educated than those of the past. The growth of academic institutions, business and industry, government bureaus, and the whole area of research put additional pressures on libraries already burdened with their own operational problems.

Because of these many social as well as economic and political factors, the role of the library has been changing from a passive custodial institution to an aggressive participant in satisfying the information needs of this country.

Computer technology is more and more being regarded as a powerful tool and one of the means available to libraries for solving not only their problems of internal operations but also those related to the expansion of services. But, as with anything new and rapidly developing, computer technology has brought on new problems; and the use of data processing equipment in libraries has often caused complications. In spite of these difficulties, however, the use of computers and

related equipment in libraries has made considerable progress so that instead of being considered a fad, automation is becoming an inherent part of library operations and services.

This report has two main purposes: (1) To give an account of the use of automation in selected libraries throughout the country, and in the development of networks, and (2) to discuss some of the "fundamental considerations" relevant to automation and the implications for library education, library research, and the library profession.

As a result of the work of the National Libraries, especially the Library of Congress and the MARC Project, and as a result of significant improvements in computers and peripheral devices, progress in library automation for all types of libraries has been particularly encouraging within the last five years.

The National Advisory Commission on Libraries and several bills pending in Congress are indicative of the interest in the information problems of this country at the national level.

Although many of the problems are yet unsolved and there is a tremendous amount of work yet to be done, the future for libraries and librarians appears exceedingly bright. There are numerous challenges to which everyone--those in education as well as those in the field--must direct their energies. The technology now exists for developing vast information networks and for making the world's knowledge accessible to every library patron. The responsibility for making this possible rests primarily with librarians assisted by computer specialists, systems analysts, experts in other fields, and the power of computer technology.

SECTION I - INTRODUCTION

There is probably nothing that has occurred in modern-day librarianship to equal the stir caused by the introduction of data processing technology into libraries. Hundreds of articles and reports have been written and thousands of words have been spoken eulogizing, criticizing, and otherwise expounding on a subject still viewed with a combination of optimism, reason, confusion, uncertainty, and misunderstanding.

This is a report on the use of data processing equipment in libraries, a subject which has come to be known as "library automation," "library mechanization," "data processing in libraries," and other similar expressions. It is an account of what library automation is, why and how it is used in libraries, what it can do, what the necessary ingredients are to make it work, and what some of the internal and external conditions are that affect its use.

It is not the purpose of this report to glorify the computer or to condemn any library, person, or group but rather to be objective in every way possible. However, most of what is known about library automation at this time must be garnered from the experiences and the opinions of those involved. Much of what the technology has to offer is attractive to libraries and needs to be pointed out. Equally important is the need to identify those things which are less attractive. What seemed in the beginning to be a simple effort to speed up processing and reduce manual routines in libraries has become a complicated endeavor utilizing the capabilities of a new, rapidly growing and rapidly changing technology in an old, established institution built on tradition. We know now that there are no easy solutions.

Many different points of view exist today regarding automation's role in libraries and information centers. Librarians become uneasy when strong statements are made that the library will disappear, the book will disappear, and the librarian will be forgotten. No one knows precisely what a library will be like even fifty years from now, but it is quite certain that some kind of institution will be responsible for acquiring, processing, storing, maintaining, and disseminating the world's knowledge. Knowledgeable laymen and interested library users hope that it will be the library. They are consciously or unconsciously relying on the wisdom of librarians to develop levels of service guaranteeing the permanence of libraries, to cope with the new technologies, to solve library problems, and to preserve the library profession, On the other hand, these friends of the library might say in all seriousness that the outcome will depend on how well the institution and the profession respond to change and to the needs of the community. Those chiefly responsible for the future of the library and the profession are the librarians themselves.

Libraries are already changing in many ways, and the hope is that they will continue to change as the needs arise. Library automation is only one of a wide assortment of opportunities and challenges contributing to change, but recognition of the need for change is far different from saying that libraries will disappear.

This report makes no claim to answering all questions that need to be answered or to solving all problems that need to be solved. Parts of it contain personal observations. All of it is predicated on two very important and very basic beliefs:

First, that the computer, as well as all other electronic data processing equipment, is only a TOOL--a very powerful and useful tool to assist libraries in meeting their objectives and goals. Computer specialists and computer manufacturers make no other claim for it. On a television program*, John Diebold, one of the best-known computer spokesmen in this country, stated again, as he and others have stated many times, that the computer is only a tool; it is here to "amplify" the mind. He further stated that the greatest problem for users today is to know how best to use this powerful technology. Peter Drucker prefers to refer to computers as "dedicated servants," but whether they are called tools or servants, the implication is that computers serve but do not replace the human mind.

Second, that there is nothing--not even a computer--that can take the place of a good librarian, a good bibliographer, a good subject specialist, or a good administrator.

For automation to find its proper niche in librarianship, it must eventually be understood by everyone in the profession. It is doubtful whether automation can succeed if only a handful of library leaders and innovators are responsible for its destiny. Librarians can reach judicious decisions regarding its use only by being adequately informed. It is hoped that this report will contribute toward a better understanding.

The report is divided into seven sections. Sections I through IV are concerned with the development of automation in libraries--how it came about and what is happening. Sections V and VI are concerned with the effect automation is having on librarianship--fundamental considerations and trends, and the implications for library education, library research, and the library profession. The Conclusions are in Section VII and there is a brief glossary in the Appendix.

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* TODAY Show, July 17, 1969.

Within the last several years the growth of and interest in automation have increased to such an extent that more than five hundred articles can easily be identified as relevant to library automation. Since several extensive bibliographies and reference lists have been published within that time, a complete list of citations would only repeat many now appearing in readily accessible sources. For the most part references cited in this report have been selected because they are current and because they are thought to have some general interest.

A. Scope of the Report

1. Library Automation Defined

The term "library automation", as well as its synonyms, appears to have no universal definition. Its ambiguity is partly due to the lack of a clear-cut definition for "automation."

Because of a lack of clarity, "library automation" has different meanings to different people. For one person it may simply mean the use of some mechanical device for performing a single library task. For another it is the concept of a sophisticated man-computer interaction capable of leading to vast networks and intercommunication systems on the national and international level.

As used here, library automation includes both of the above concepts and the many levels in between. A definition of library automation suitable for this report is: "The use of electronic data processing equipment in connection with acquiring, processing, storing, and maintaining the collection; with making the collection available to patrons by circulation, reference services, interlibrary loans, and telecommunication; with creating and maintaining the many records, including the bibliographic apparatus, necessary for proper control of the collection and for providing service to patrons."

Electronic data processing equipment includes not just computers with their peripheral devices but also punched card equipment, paper-tape equipment, and other non-computer machines.

Essentially, library automation involves practices common to all libraries in handling and controlling the physical documents; but because of the capabilities of data processing equipment, it extends somewhat beyond the usual housekeeping and recordkeeping routines of traditional library operations.

This definition of library automation does not include what is implied in such expressions as "information retrieval," "information processing," "information handling," or "machine literature searching." Most people regard these expressions as referring to the processing of the contents of books, articles, and reports and to resulting products such as abstracts, extracts, and deep indexes.

The decision of what to include and exclude in the definition of library automation as used in this report is based on two premises: (1) information retrieval is not included because the steps taken to process and control the contents of a document are quite different from those taken to process the physical document; and (2) processing by noncomputer equipment is included because the preliminary steps taken are similar to those for using a computer and in many libraries the use of noncomputer equipment preceded the use of a computer.

2. Coverage

It is hoped that this report provides some insight into the automated activities taking place in academic, public, and special libraries throughout the United States. School libraries are not included, because much of their effort is being directed to the formation of educational or instructional media centers. Libraries in other countries are not included, because there was no opportunity to gain first-hand information about their work. Furthermore, this report does not cover the state of the art since it makes no attempt to include information about all of the more than one thousand libraries involved in automation.

It is not a research report in the sense that the work was performed in a laboratory and the findings are clear-cut and indisputable. It is not a scientific survey, because no recognized statistical methods were used to gather the data. It does, however, attempt to reflect the opinions and attitudes of some of the many who have committed themselves to developing better techniques for better libraries and who have offered advice and suggestions that may be helpful to others.

Although data have been collected and the literature reviewed over a period of years, much of the information, especially that pertaining to specific libraries, was gathered during the past two years from site visits and personal communications. Summaries of the operations in specific libraries appear in Section IV.

Most of the libraries contacted have progressed to the point where they have no thoughts of reducing their involvement in automation or reverting to former methods. They do not pretend to have all of the answers or to know precisely where they will be in systems development five or ten years hence. They are attempting to develop systems that will be compatible with future needs. They have problems now and expect to have problems next year--and the next, but they also expect to realize a fair amount of success. The attributes which prevail within these libraries are those which seem so important for progress--openmindedness, enthusiasm, flexibility, dedication, and a very realistic approach to problem solving.

The reader must continually realize that the use of the technology in libraries is comparatively new. There is much that we do not know, and relatively little has been proved. Testing and experimentation are a necessary part of development in order to bring the library and automation into a successful working relationship.

B. Need for a Critical Review

There have been numerous reviews, bibliographies, and state-of-the-art reports on library automation, but there has been very little attempt to analyze it by bringing the various aspects and complexities together. Now that the MARC (machine-readable catalog) project of the Library of Congress has reached the stage where a subscription service is being offered and many other libraries are involved at many different levels, the time seems appropriate to look both backward and forward in analyzing the development of automation in the library.

In some ways it could be said that library automation is reaching the end of the "infant" era and is becoming a youth. It has proved its strength and potential enough so that a growing number of librarians are convinced that automation in the library is inevitable to some degree, even though the extent is not yet fully known. They do not consider it a panacea for all ills or a solution to all problems. They do believe, however, that it offers the best means known at this time for solving many of the problems; and more importantly, it opens the doors for greater and better library and information services than ever before possible. They further believe that librarians themselves must eventually be responsible for the fate of library automation and that the problems inherent in adopting new approaches are tremendous but solvable.

Many questions as yet have no answers, and the consensus on certain topics is by no means universal. At times it may appear that the problems outweigh whatever good might be derived, but the reader must bear in mind that only by having an awareness of both the potential and the problems can he expect to have a satisfactory understanding of automation in the library.

In discussing a topic as fluid as this one, there is a temptation to make broad generalizations and sweeping statements. An effort has been made to keep such statements minimal. On the other hand, library automation is not yet a very orderly subject and at times a generality is about all that exists. Many of the comments represent stated and often published opinions of a number of highly regarded practitioners who speak from experience and who are interested in building, not destroying, their profession.

C. Why Automation in Libraries is Difficult and Complex

Library automation is difficult because it is complex, and it is complex because it is composed of so many parts that are intricately interrelated. It is further complicated by the fact that the use of data processing equipment has introduced into libraries not only strange machines but also practices and techniques hitherto not considered necessary.

Library operations performed by any method are difficult, and so are data processing techniques. To bring them together tends to compound the problems. Each is guided by a somewhat different philosophy. Over the years, individuality has been the hallmark of libraries, and it is only in recent years that this cherished characteristic has been challenged. Automation, on the other hand, yields the best results with standardization. Automation is most efficient when processing vast quantities of numeric data such as are required by business and industry, but libraries are probably the greatest processors of nonnumeric data. To merge library processing and automation requires gathering into a working relationship certain diverse elements which heretofore had little in common.

For centuries, libraries have been processing and storing their materials and creating and maintaining their records, with each library operating in its own way. It was not very important that Library A did things differently than Library B because their contacts with each other were not concerned with processing routines. Similarly, in Library A it was important for each department to know the responsibilities assigned to other departments, but it was not necessary for each one to know precisely how the others kept their records or managed their separate tasks. It made little difference in circulation if acquisitions recorded orders on 3 x 5 cards or if the cataloging department made cards on a duplicating machine. Whatever they did had little effect on what took place in circulation. Because there was no particular "need to know," departments often tended to drift apart and work in relative isolation.

With the advent of automation, the battle cry became one for cooperation and coordination. Within the library itself, automation has meant bringing people together who are not accustomed to sharing their practices and routines; it also meant bringing together a variety of operations that had often been handled in quite dissimilar ways.

Besides the problems created by trying to join forces internally, automation has brought in from the outside a new set of elements which have made the basic ingredients for operating a library even more complex. For example it has introduced:

- people of diverse backgrounds and interests who had not been accustomed to communicating with library personnel--systems analysts, programmers, computer specialists, manufacturers' representatives, and machine operators.
- equipment, unfamiliar to librarians, that was designed with little concern for library needs.
- programs or instructions for the equipment over which libraries have had little control.
- management and scientific planning techniques which most librarians have not ordinarily used.
- a concept of interaction and coordination different from that existing in traditional library practices.

Data processing specialists who have come to the library have also not escaped without problems. They have encountered procedures and applications unique to libraries, which they may not understand fully and tend to oversimplify. The kinds of materials to be processed and the supporting records to be maintained have some features not ordinarily found in business and industrial applications.

Somehow these various elements must be brought together to provide the many services for which libraries exist.

Introducing automation into the library should be considered much more than just transferring a manual operation to a machine or merely perpetuating old practices with the assistance of some data processing equipment. Automation offers opportunities for library service never before possible, but it also is very demanding. It requires a team involvement calling upon the combined talents of librarians, systems analysts, and computer specialists. It requires equipment and programs, money in ample supply, and sufficient time and dedicated effort to accomplish intended results. It requires finding out what should be done before deciding how to do it; the objectives at any given time must be definite but flexible and open-ended. But most importantly, automation at any level will be of little value unless the library patron is recognized at all times as the eventual beneficiary of this technology.

There is no question that, in the beginning, only a very few librarians were prepared for what automation could offer, and the great majority of computer people had little conception of library needs. The result was a dreadful lack of communication. Supposedly this failure to have satisfactory communication has improved, and it has to a degree; but much too frequently a serious communication gap still exists. On the brighter side, however, is the growing number of librarians, systems analysts, and computer specialists who do understand and can communicate. The present problem is that the number is not growing fast enough to meet the urgent need.

SECTION II - CIRCUMSTANCES LEADING TO AUTOMATION IN LIBRARIES*

To put in proper perspective activities that are taking place today, it is necessary to review some of the events of the past. This section is concerned with tracing the development of data processing equipment and with circumstances encouraging the use of this equipment in library operations.

A. The Equipment

Although the history of the punched card, punched paper tape, and the computer goes back to the 17th, 18th, and early 19th Centuries and makes interesting reading, events of recent times are more relevant to this report.

Punched paper tape, as far as can be determined, has been used continually over the centuries for a variety of purposes and seems to have no definite modern-day beginning. The early use of modern-day punched cards and computers can be more clearly identified.

1. Punched Cards and Unit Record Equipment

Today's version of the punched card was developed in the 1880's by Dr. Herman Hollerith, a statistician employed by the U. S. Census Bureau. He and his colleagues felt that some mechanical means could be devised to process great masses of data and maintain records which even then were causing problems. It had taken seven years to complete the 1880 Census for 50 million people; it was expected to take ten years for the census of 1890 if the same methods were used. As a result of Dr. Hollerith's efforts, the 1890 Census was compiled in just over two years for 62 million people.

Hollerith's system used a pattern of holes punched in cards or paper strips to be "read" by a magnetic principle. The pattern of holes that he devised is the punched card code most widely used today and is often referred to as the "Hollerith code;" the cards are frequently called "Hollerith cards."

Since the cards were of little value unless the data they contained could be manipulated in various ways, Hollerith obtained patents on several processing machines and formed the Tabulating Machine Company to produce them. This original company merged with two others in 1911 to become the Computing-Tabulating-Recording Company, which in 1924 changed its name to the International Business Machines Corporation (IBM).

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* References for Section II appear at the end of Section II.

In 1910, after Hollerith had left government service, the Census Bureau hired James Powers, an engineer, to develop some tabulating equipment. He also obtained patents and formed a company which in 1927 merged with Remington Rand and is known today as Sperry Rand.

The success of these new techniques spread rapidly for they came just at the proper time. This country was entering a period of great technological development and growth. Many new products including such everyday items as automobiles, radio, aircraft, and synthetic materials came into being. Mass production principles were being widely adopted and transportation facilities were being expanded. It was the era of heavy immigration and the rapid growth of cities. It was the beginning of our complex society which, we know only too well, requires organization and elaborate systems of record keeping and control.

The need to provide better ways of handling records was evident, and the use of punched cards had proved feasible. As a result, a vast array of specialized machines was developed to process the cards in many ways. Cards could be punched, verified, printed, sorted, matched, merged, selected, and reproduced on different pieces of equipment. From the data on the cards, printouts could be made and simple calculations could be performed. Over the years each new model has become faster, more efficient, and more economical, but the primary purpose of each machine remains the same today as it was then.

The specific machines designed to perform these various tasks are now known by such common names as printing keypunch, verifier, interpreter, sorter, collator, reproducer, and printing accounting machine. Because each machine operates independently as a single unit when processing the cards, the combined group is known collectively as UNIT RECORD EQUIPMENT or TABULATING EQUIPMENT.

Although still much in use today, this equipment does have some recognized limitations. Since each piece of equipment is capable of performing only one or two specialized jobs, an operator must move the cards from one machine to another to complete the processing steps. As far back as the 1930's it became apparent to the designers that a single multipurpose piece of equipment capable of coordinating and performing all of these tasks would be more advantageous. Shortly this idea was translated into the ancestors of today's computers.

Computers have now replaced Unit Record Equipment as the principal machines used in data processing operations, but combinations of the unit record machines continue to be used in most computer centers as supporting equipment.

2. Computers

The history of today's computers is much shorter than the history of punched cards and related equipment. Some of the initial ideas for computers were formulated in the 1930's, but the ideas were not translated into actual machines until the 1940's when several one-of-a-kind models were made. These crude, experimental pieces of hardware were put together in a number of research laboratories, usually under Government sponsorship and for Government use; they were not available in the open market.

The first "assembly-line" first-generation computer was delivered to the business world in 1953, and these machines thrived for the next five years. Although their distribution was limited, they received immediate acceptance. By today's standards they were truly "monsters" or "giants," as they were frequently called; they operated with vacuum tubes and electrical relays and were gigantic in size with gigantic requirements for electrical power, humidity control, and heat control. But even then the public was beginning to appreciate the impact of electronic computers.

By the late 1950's the development of transistors and other electronic improvements enabled the manufacturers to incorporate these new advances into the second generation of computers. Computers became faster, of more manageable size, and considerably more economical to operate. It was at this time that there was a sharp upward turn in usage, and computers were truly becoming a regular part of the American scene.

It is now 1969 and third-generation computers have been available for several years. Within this relatively brief span of less than twenty years as a commercial product, computers have changed drastically and have had a direct effect on our economy in a multitude of ways. The increase in operating speed alone has been phenomenal. The first generation (using vacuum tubes) measured its processing speed in milleseconds (thousandths of a second); the second and most of the third generation machines in microseconds (millionths of a second); the most advanced equipment measures its speed in nanoseconds (billionths of a second--a million times faster than those of the first generation).

There are two basic kinds of computers--analog, which measure (such as a thermostat); and digital, which count. Digital computers are divided into general purpose and scientific; general-purpose digital computers are the type used for library operations. They are available in a wide range of sizes and capabilities. Regardless of the size or type, computers all have the common feature of internal storage, which some call "memory," and of accepting operating instructions from internally stored programs.

Besides internal improvements, there have been many developments in the peripheral devices attached to the computer for input, storage, and/or output. The early computers accepted only the codes of punched cards and punched paper tape and could provide output only in the form of punched cards, punched paper tape, or a printout. Today input, storage, and output equipment also includes magnetic tapes, magnetic disks, magnetic drums, data cells, optical character recognition (OCR) devices, typewriters and other data transmission equipment linked to the computer, cathode ray tubes (CRT), and photocomposing machines. The choice of peripheral equipment available for input, storage, and/or output is constantly being expanded.

An abbreviated glossary of computer technology appears in Appendix A to assist those unfamiliar with the terminology.

When considering automation and its use in the library, it is important to recall that for all practical purposes the computer industry is scarcely more than ten years old. The equipment was developed mainly for scientific computation, research, and business applications, but not for libraries. Many of these users do not yet realize or appreciate its full potential. Consequently librarians can take some justifiable consolation in the fact that much of what has occurred in the past was inevitable, but the shortcomings of the past do not excuse apathy and inertia in the future.

B. The Library and its Need for the Technology

For the past thirty years, American society has undergone a greater variety of changes than in any like period in its history--social, educational, economic, scientific, and political, to name a few. Though the changes have been more dramatic in some areas than in others, scarcely an institution, least of all the social agencies, has escaped. Most are being required to take not just a new look but a much more intensive look at themselves and their sense of purpose in relation to modern society; so it is with the library.

There is general agreement within the profession that the role of the library is changing. There is also wide-spread recognition of certain persistent problems. Neither its role nor its problems will, of course, be solved by automation alone; but it is a technology that has already proved capable of providing more than token assistance.

Library automation is not just a fad. Its progress, uncertain as it seems at times, has been the result of actual need. Certain problem areas will be more directly affected than others; but, because everything within a library is somehow interrelated, undoubtedly the total effect will eventually be felt in every segment of library operations.

Four problem areas in particular seem to identify closely with automation:

1. The Increased Volume of Printed Materials

Literally dozens of articles have been written about how many printed pages are being cranked out every minute, every hour, and every day in this country and throughout the world, so it is not necessary to pursue these statistics further except to note their effects on libraries.

It is the area that has received the most attention and certainly provided much of the impetus for the use of data processing equipment in libraries as well as for the development of information science and the establishment of information centers.

The quantity of materials pouring into libraries suggests the need to seek better processing methods. An even bigger problem, as Kilgour points out (1), is to locate those materials that are already processed and exist in some collection. The urgent demand for materials that cannot be located causes dissatisfaction and a dilution of services.

Until such time as libraries become major forces in controlling publications, the alternatives seem to be greater selectivity and improved processing methods. Automation can assist both in selecting materials and in processing them.

2. Finances

In the beginning it was believed that automation would save money. For some libraries there have been savings in limited areas. For others it has been the most expensive exercise yet attempted.

It is now generally conceded that, on a long-term basis, automation must prove economically feasible. This does not necessarily mean actual dollar savings. The question of feasibility should eventually be resolved in terms of library objectives and services, and these in turn should be determined by librarians.

Budgets are larger and funds more plentiful than ever before, but demands are much greater and the dollar buys less and less. While recognizing the importance of making long-term plans, the library is faced with the immediate need to secure adequate funds for meeting objectives and to spend those funds wisely.

a. Securing a rightful share of the funds available

Although basically economic, the quest for money also has political overtones--political in the sense that the library is competing with rival groups or agencies for its share of the total, whether from the public domain or the private sector.

Numerous articles written by librarians refer to the increasing possibility that libraries will have to justify their expenditures just as other agencies are required to do and that their best recourse is reliable operating information.

It has not been unusual for a library to have difficulty in presenting a good case for its needs before the proper authorities. Presentations are much more effective in meeting the competition if they are straightforward, objective, and decisive and if they are based on factual information and reliable statistics rather than intuitive statements and personal feelings.

b. Using available funds in the best possible way

Adding new materials to the collection is a major factor in maintaining a dynamic and viable library. And yet, in some libraries the proportion of the budget allocated for new materials has become shockingly low while the processing costs continue to rise. Some drastic measures need to be taken to reverse both of these trends. It is not enough to rationalize and alibi or to tackle the problems with words rather than deeds.

Those who are alert to the problems recognize that there are far too many practices carried on in some libraries today that are wasteful and expensive and in only small measure contribute to the meaningful objectives of these institutions.

What all of this suggests is that in certain operational areas a more business-like approach should be considered. Automation can provide useful management information that enables libraries to be more definite in detailing their needs for funds and thus more competitive with other institutions. Automation can make operations more efficient by eliminating duplication, by handling materials more rapidly, and by coordinating various processes. Automation can also provide the means for intercommunication and the sharing of resources among libraries, which in itself is a great step forward in expanding services.

By today's standards, a computer is an expensive adjunct to library operations; that is until one considers the alternatives. People performing manual operations are becoming increasingly costly to support. Machines performing similar tasks are becoming less costly to maintain. How well each library is able to balance these two costs could determine its future.

3. Manpower--Professional and Nonprofessional

The manpower problem has been identified and widely discussed as a problem, but it is not yet resolved. The number of library school graduates each year continues to be but a small percentage of all professionals graduated.

Librarianship competes with other professions in providing status, monetary return, and satisfying, rewarding experiences for the well-qualified student. It has all the necessary ingredients to offer challenging, intellectual experiences to candidates. Unfortunately, for some well-qualified students who would make excellent candidates for librarianship, too much of the old imagry of librarians remains, and they look elsewhere for a career. They are not yet convinced that librarianship is an active and dynamic profession.

The best hope for immediate improvement in manpower shortages is "to use library professionals in a truly professional way," a well-worn cliche but still a timely one because the message has not yet come through loud and clear.

The shortage of nonprofessionals may be inconvenient but by no means as serious. Automation has already proved its worth in handling routine and clerical tasks and in using nonprofessionals more efficiently.

The concentration of manpower effort should rightly be directed to the profession--recruiting talent with a promise of genuine professional opportunity and, more important to the new professional, keeping that promise by utilizing to the fullest the best talents each individual has to offer. If automation makes any contribution toward reaching this goal, it has earned a rightful place in librarianship.

4. Extended Services

This last major problem area is, of course, the most important as it is the "reason for being." Concern for the quality and extent of services represents the heart of the institution toward which all else should be focused.

We know that automation can provide techniques enabling libraries to expand their services to dimensions previously considered impossible or impractical. It is for librarians to determine what these dimensions will be. This is no small responsibility, but it must be met now and in the years ahead.

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SECTION III - DEVELOPMENT OF AUTOMATION IN LIBRARIES*

This section traces the development of automation in libraries from 1936 to the present time. It notes some of the significant events that encouraged use of the technology and summarizes the processes and applications for which libraries are using automated techniques.

A. Periods of Development

Automation in libraries began over thirty years ago when the problems were just beginning to get serious. Its development coincides with the great growth of electronic equipment, although the advancement in libraries has been much more sporadic.

Several libraries have long and continuous histories of using data processing equipment, but the greatest progress has been in the last 6-7 years. In tracing the development over the last thirty years, it seems that its progress falls roughly into three periods:

1. The Pre-computer Period of the Late 1930's through the 1950's

The first announcement of the use of data processing equipment in a library appears to have been made by Parker, who installed a punched card method for circulation at the University of Texas on February 1, 1936 (11).

The next ones noted were at the University of Florida early in 1941 (6, 12) and the Montclair (New Jersey) Free Public Library early in 1942 (13, 14, 15). Both used IBM machines for circulation control. During 1951-52, King County (Washington) Public Library produced and printed the first book catalog (one-line entries) using data processing equipment (1).

From then on through the '40's and '50's other libraries--public, academic, special, and school--reported their experiences in the use of punched cards and data processing equipment. This group included such libraries as:

Abbott Laboratories Library

Brooklyn College Library

Decatur (Illinois) Public Library

Douglas Aircraft Company Library

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* References for Section III appear at the end of Section III.

IBM Library, San Jose, California

IBM Library, Yorktown Heights, New York

Lake County (Indiana) Public Library

Library of Congress Order Division

Lindsey Hopkins Vocational School and Miami Technical
High School (Miami, Florida) Libraries

Los Angeles County Public Library

Massachusetts Institute of Technology Library

Milwaukee (Wisconsin) Public Library

University of Missouri Library

Sandia Corporation Library

Stockton and San Joaquin County (California) Public Library

The types and sizes of libraries represented in this list of examples indicate the interest in using data processing equipment during this period. References to these early activities will be supplied upon request, but the citations are not listed here because they are now mainly of historical significance. Many of these operations have survived and flourished, and a number of them are described in Section IV.

All of these libraries used punched cards and unit record equipment. About half used the equipment for circulation control; several for preparation of book catalogs and bibliographic control; and three were already combining several applications. Other uses were ordering, serials holdings, book cards, accessions, account control, and statistics.

During this period punched cards and the equipment that manipulated them were thought of as labor-saving devices to eliminate or reduce some of the monotonous, repetitive manual processing. Considering the capabilities of the equipment available at that time, not much more could have been done.

2. 1960-1962

Computers by this time were becoming an important economic force. They were being used increasingly for scientific research requiring complex mathematical computations and for accounting and recordkeeping functions requiring the handling of vast quantities of data, most of which were numeric. Universities as well as the

Government and the private sector of business and industry, were becoming principal users.

The presence of computers and other data processing equipment in organizations of which they were a part encouraged a number of special and academic libraries to become involved in automation during this time. One gets the impression that a few librarians saw the potential and initiated the idea to use the equipment, but that there were more who were encouraged, urged, and even pressured by their administrations, their patrons, or the computer people to "modernize." The latter approach did not always prove to be a satisfactory experience for the libraries and resulted in some costly and unsuccessful experiments.

In spite of the frustrations, however, there was progress. Some of the earlier users transferred their processing from unit record equipment to computers. Others converted their manual records to punched card equipment or to a computer, depending on what was available to them. Regardless of the machines used, most were concentrating on only one or two applications; the idea of a "system" which would coordinate a variety of tasks was just beginning to emerge.

During this time there was not much tangible evidence of "system development," but numerous public, academic, and special libraries were making feasibility studies and surveys with that in mind. No one was proceeding on very firm ground with regard to expanding beyond circulation and the housekeeping routines, but there was an awareness that much more was possible with computers than with punched card and paper-tape equipment.

Compared to the 20-30 libraries engaged in automation in 1960, by 1963 there were 50-75 actually in the process of converting records and performing a limited number of routines. There were many more studying the problems and making plans which would bear fruit at a later time.

3. 1963-Present

Much of the preparation and planning started in the early '60's resulted in actual implementation within the next few years. From the literature one can conclude that libraries using data processing equipment soon numbered well into the hundreds. Several significant events and developments undoubtedly contributed to the increase.

The work at the Library of Congress was perhaps the one of most direct significance to libraries in general. Late in 1963 a report entitled Automation and the Library of Congress (7) was published. The report contains the results of a feasibility study and detailed survey make for the Library by an outside team.

An important conclusion drawn from the study was that automation of the major operations within the Library of Congress was both desirable and feasible and that immediate action should be taken to establish an extensive program. The team further concluded that the immediate objective of automation should be to solve the pressing problems facing large research libraries, especially those of bibliographic organization and control. This report with its conclusions and recommendations has become the basis for much of the work in automation now in progress at the Library. A summary of these activities appears in Section IV.

If one were to pinpoint a time when library automation began a significant upturn, it might well be when Automation and the Library of Congress was released. The Airlie conference on libraries and automation, held in May 1963 and reported in the proceedings published in 1964 (8), was further evidence of the sincere interest the Library of Congress had in using the new technology.

Libraries that appeared quite indifferent before seemed to take a new interest. Libraries already involved began to think more seriously about "systems" rather than separate processes. More effort was spent in designing, analyzing, testing, and evaluating than had been done in the past. Some of the techniques of systems analysis and scientific management, which had been mentioned in the literature for at least ten years, were now being put into actual use.

Although the Library of Congress provided much of the spark for library interest, computer technology made it all possible. Aside from the increasing number of computers available and the encouragement libraries were receiving to use them, extensive improvements in the computers themselves, the supporting peripheral devices, and the software made the technology much more attractive to libraries.

Furthermore, enough time had passed since the introduction of computers to enable a few librarians to become trained in the technology. They were in a position to assume responsibility for designing and implementing larger, more intricate systems than had been possible heretofore.

Conferences, institutes, and symposia on various aspects of automation in the library were held throughout the country. Increased attention was given to centralized processing, cooperation, and coordination of resources; and speeches and articles emphasized the need for networks at different levels. EDUCOM (Inter-University Communications Council) was born, and all kinds of surveys and studies of library resources were under way.

Since so much was happening and so much was being reported in a wide assortment of journals, it was difficult to keep up with the published literature. It was even more difficult to secure papers and reports which were informative but never published. Two organizations came to the rescue--the American Documentation Institute (ADI), which has since been renamed the American Society for Information Science (ASIS), and the Library of Congress.

The American Documentation Institute decided to publish an annual review to consolidate the latest developments in information science and technology. The review was to be divided into chapters, each one to concentrate on one aspect of information science and to contain an extensive bibliography at the end of each chapter. One of the chapters would be concerned with library automation.

Volume I of the Annual Review of Information Science and Technology was published in 1966; Volumes II, III, and IV followed in 1967, 1968, and 1969 (2, 3, 4, 5).

Each volume is intended to cover the literature of the previous year. Since Volume I was the first, it covers the literature from 1963. The chapters on library automation vary in title but contain the same basic information. In 1966 the chapter was called "Library Automation;" 1967, "Automation in Libraries and Information Centers;" 1968, "Automation of Technical Processes in Libraries;" and in 1969, "Library Automation."

About the same time that ADI became active, the Library of Congress established an office called "Library of Congress Automation Technique Exchange," more familiarly known as LOCATE. One of the purposes of the office was to collect information on library automation from all kinds of libraries, especially reports which would ordinarily have limited distribution. Since the collection does not circulate, the office acts as a referral center. The June 1967 issue of the ALA Bulletin contains a "Bibliography of Library Automation" (10) prepared by the LOCATE staff.

More recently the ERIC Clearinghouse for Library and Information Sciences (CLIS) at the University of Minnesota has assumed the responsibility for gathering materials on library automation and preparing bibliographies. This group has updated the 1967 LOCATE bibliography through 1968. This new list of references appears in the ALA Bulletin for September 1969 (9).

Because the bibliographies in each volume of the Annual Review and those published by LOCATE and ERIC/CLIS are comprehensive and readily available, only a few citations from 1963-67 appear at the end of this section.

Another interesting development during this period was the seemingly improved relations between librarians and information people. One can recall some years ago when the two groups seemed more like adversaries than co-workers in a common cause. No doubt some of the old unfriendliness still remains, but the national organizations at least recognize each other. ASIS (ADI) has recognized the importance of library automation by a chapter in the Annual Review and by the formation of a special interest group called "Special Interest Group on Library Automation and Networks (SIG/LA)." The American Library Association has recognized information science by forming ISAD (Information Science and Automation Division).

Progress at the national level was given additional impetus by the MARC Pilot Project of the Library of Congress. This project involved libraries of different types and provided opportunity for public, academic, special, and school librarians to communicate. Other cooperative-type projects were under way throughout the country, some by type of library and some by geographic area.

Late in this period a new concept was introduced to library automation--real-time, online processing. Several libraries had access to computers with time-sharing capabilities. A typewriter terminal, cathode ray tube (CRT), or some other remote-access device was located in the library but connected directly by cable or wire to the central processing unit of the computer located some distance away. In the opinion of many librarians who have been involved in automation, the online approach offers a significant breakthrough for improvement of internal operations within libraries and for easing the technical problems connected with centralized processing, sharing of resources, and network developments. In common with other new technical developments, the cost of online processing is as yet too high to be feasible in most libraries; but it is certain that the cost will be reduced to a reasonable figure in the not too distant future. Several online systems are summarized in Section IV.

B. Summary of Automated Processes

By 1969 libraries of all types were automating a wide variety of processes in acquisitions, bibliographic control, and circulation. The majority of the applications were designed and implemented for the handling of books, to a lesser extent serials, and in a few cases technical reports. For processing by manual methods it has been customary to separate monographs (books) and serials because of the differences in their handling requirements. This practice has carried over to automation.

No one library has automated all possible operations. Each library has combined tasks in the way it thought best for its particular needs. Although many began with only one or two tasks, it appears that the majority are expecting to expand as conditions become favorable.

Many libraries have automated some part of the processing of both books and serials, but few if any libraries have incorporated them into a single "system." The list below gives examples of separate tasks and applications which have been automated for monographs and some of the additional tasks required for serials. A glance at this list will give some indication of why books and serials have not been combined.

1. Monographs

Although the separate operations performed to acquire and prepare monographs are related and connected, it is possible to begin automation with one or two tasks without immediately involving the others. The separate tasks given below are indicative of the kinds of work being accomplished in libraries with the assistance of data processing equipment.

a. Acquisitions

Pre-order searching, preparing purchase orders; maintaining on-order file, in-process file, standing order file; claiming; budgeting; fund accounting; approval or payment of invoices; vendor lists; accession lists; want lists; status reports.

b. Bibliographic Control--Cataloging

Machine-readable catalog; catalog card preparation; book catalogs and supplements; union catalogs; shelf lists; authority files--name and subject; book cards, pockets, and labels; online input to computer of bibliographic data; status reports.

c. Circulation and Reference Services

Charge out; charge in; patron register; circulation lists; overdue notices; collection of fines; recall; reserve; requested materials; interlibrary loans; special lists or bibliographies; statistics of various kinds such as on book usage and users.

2. Serials

Serials are much more difficult to process than books. Serials are continuous and include so many variations in the publication and frequency patterns. They are also handled in different ways. While most libraries follow fairly standard practices in the way they order, catalog, and circulate books, there is a wide variation in the way serials are treated. Some libraries catalog serials, some do not, and some catalog only the bound volumes. Some circulate all serials, some circulate none, some circulate bound volumes but not individual issues, and some do just the reverse. Some bind and others do not. In some libraries serials are retained permanently and in others they have a limited shelf life.

And so, although serials and books have a few tasks in common, others are not necessary for book processing. Serials processing requires procedures for handling subscription ordering, renewal notification, check in of current issues, claiming missing issues, acquiring back issues, and preparing binding notices and slips. Procedures also may include preparation of arrival lists, routing slips, local and union holdings lists, and special lists and bibliographies of journal articles.

For a few years the automation of serials received considerable attention because serials processing is recognized as one of the most serious and difficult processing problems in many libraries. The most success with the automation of serials has been in medium-sized academic libraries and in special libraries; several have had successful operating systems for years.

Some of the large libraries, however, have become discouraged in attempting to handle the daily check in of issues by using "arrival cards" and other offline methods. Some of these libraries have upwards of twenty thousand current titles in their serials holdings; offline check in and batch processing appear to be inadequate and inefficient for a collection of this size. In the opinion of the librarians responsible for these large collections, the use of online facilities is the only satisfactory answer to their problems. Consequently these libraries are temporarily limiting the automation of serials to the production of holdings lists and to ordering routines. Until such time as online equipment is available to them, they will exclude check-in procedures from their automated activities.

Over the years circulation control, the preparation of catalog cards, the printing of book catalogs and supplements, and the preparation of purchase orders have probably been the most common applications; but libraries are expanding into other operations as indicated above.

Today there is a wide range in the degree of sophistication of equipment and techniques used in libraries. Although the trend is definitely toward computer usage, a number of libraries are still using only punched card and/or paper-tape equipment with satisfactory results. In some cases the libraries are just beginning and have, for the time being, limited their activities to only one or two applications. Others, as shown by some of the examples in Section IV, are well on their way to operational integrated systems. Almost all libraries now engaged in automation have much greater plans than they have as yet been able to implement. This is not a criticism but a practical approach to automation. Libraries have made some genuine progress in spite of adversities and are expecting to continue with further accomplishments.

The period since 1962 represents the beginning of the real growth of automation in libraries. During this time libraries began to think in terms of systems and to exploit to a greater degree the capabilities of computers. More information and ideas were being exchanged, and the foundations were being laid for greater cooperation in the future.

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SECTION IV - AUTOMATION IN LIBRARIES TODAY

According to estimates, more than one thousand libraries are now directly engaged in automation at some level. Additional libraries are affected by automation as members of centralized processing groups or as clients of outside contractors that provide processing services.

This section is concerned not so much with the past or the future of automation in these libraries but with what is happening today. The first part is a general discussion of patterns of operation, the second part summarizes in considerable detail the work going on in a number of selected libraries, the third part lists a number of other libraries reporting on their activities within the last two years, and the fourth part briefly discusses a few of the many cooperative projects being planned, under development, or in operation throughout the country.

A. Patterns of Operation *

First off--there are no prescribed patterns of operation. If a library decides that automation has a place in its operations, it has no single source from which to obtain useful criteria or guidelines. In the absence of prescribed patterns and criteria, which we assume would be helpful in easing the transition to automation, libraries use a variety of approaches usually determined by a combination of their own requirements and outside circumstances.

1. Working toward a System

Many who are responsible for planning automated projects talk about developing a system, and some go further and talk about a "total," "complete," "integrated," or "coordinated" system. What is meant by these terms very much rests in the minds of the planners, but it is not always clear to others. Part of the confusion is caused by the fact that "system," "total," "complete," "integrated," and the like are quite nebulous words.

Although a more detailed discussion of systems appears in Section V.B., it is sufficient at this time to think of a system as "a unit composed of interrelated and coordinated parts."

"Total" and "complete" suggest all-inclusive, everything, or finished. Those experienced in automation agree that a total system would include not only the integration of all internal processing operations, but also information retrieval capabilities and services and network participation. In this concept there are as yet no total systems, as DeGennaro (1) and others have pointed out. Some special libraries have "total" system goals, but the majority of libraries are not considering automated information retrieval services at this time.

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* References for Section IV.A. appear at the end of Section IV.A.

"Integrated" and "coordinated" imply something less final or complete. Kilgour prefers "comprehensive system" (2) as the expression which most accurately describes what the majority of libraries are striving toward in the near future.

For an automated system that goes beyond one or two single applications, machine-readable data bases are not only desirable but necessary. Records in machine-readable form can be updated with relative ease, and the data can be used over and over again in many places and for many purposes within a single library, and as a communication medium among libraries. A few libraries already have machine-readable data bases of substantial size, but a greater number are now in the process of creating the records.

A number of libraries have been successful in combining and coordinating individual processes and routines into a continuum from the beginning to the end, i.e., from the early steps in acquisitions through circulation control. This type of automated processing may or may not require the creation of a machine-readable data base. Monographs and serials continue to be handled separately when using automated techniques just as they have been separated in manual processing.

What is actually happening in many libraries might better be described as a series of automated applications which fit well together. This approach is a practical one and may actually be preliminary to an integrated system planned at some later time.

Theoretically it appears possible for a library to begin automation of all parts of a plan at about the same time, but any director of an established library knows that such an approach is not only impractical but virtually impossible. No library can close its doors while converting to automation. The alternative is to progress in phases or steps for a gradual changeover in order to avoid a disruption which would result in utter chaos in daily operations. A new library with a long lead time before it opens its doors to the public can come closer to this approach, but even new libraries have had to modify their original plans and make adjustments so that implementation could be made in modules, phases, or a series of steps.

Anyone working in the field of automation soon learns that it is a long-term, continuing project and that no operating system suddenly bursts forth in full bloom. The larger the system the longer it takes between design and implementation. The design should not be a static set of procedures, such as characterizes so much manual processing, but a dynamic configuration of many parts coordinated to accomplish an ultimate objective.

A few fortunate libraries, especially the very large ones or the new ones heavily committed to automation from the beginning, are able to maintain separate staffs or offices to work on automation problems independent of the day-to-day operations. During the design and development stages of the work, they can plan, test, and evaluate without interfering appreciably with the normal work. It is only when actual implementation is in sight that the regular staff becomes directly involved.

An early step toward automation, most will agree, is to decide the needs based on the library's major objectives and determined by a complete and detailed analysis of present operations. Once the needs have been defined, the next decision is concerned with "how" to do it --priorities of tasks, scheduling, funding, staffing requirements, etc. These considerations are discussed in Section V.

2. Why Libraries Do What They Do

Aside from the very basic considerations of adequate budget, qualified personnel, administrative attitude, equipment accessibility, size and type of library, etc., which are discussed elsewhere, libraries have different reasons for deciding priorities of tasks. The list below gives examples, several showing opposite points of view and some obviously containing more substance than others:

a. Capturing the data at the first point of entry

Those who agree with the theory that "the data should be captured at the first point of entry" often begin automation in the acquisitions department. Whatever is known about a document, e.g., book, at the time of ordering is put into machine-readable form. Other bits of information are added during processing, e.g., call number added when the book is cataloged. This approach has many advocates, several examples of which are given in part B.

b. Capturing the data for bibliographic organization and control

Not everyone believes that information should be captured in machine-readable form at the point of acquisition and updated when bibliographic information is available. Some believe that complete bibliographic data should be entered at the time of cataloging and made available to other departments. This is the approach used, for example, at the Library of Congress and the Los Angeles County Library. The rationale behind this approach is that much of the data captured early in processing, e.g., ordering information, is useless at the cataloging stage and much of the data needed in cataloging for bibliographic control is not necessary for acquisitions.

c. Other reasons for specific applications

(1) Selecting the easiest application to gain experience for the more difficult work to come.

(2) Selecting the most difficult application and, therefore, presumably most in need of automation, e.g., serials handling.

(3) Selecting an operation that can stand alone while developing other areas to add to the system, e.g., circulation, serials.

(4) Selecting an operation that will yield rather quick results, e.g., budgeting and accounting, and perhaps circulation.

(5) Selecting an area that will yield a product useful to library patrons, e.g., book catalogs.

(6) Selecting an area that will show the public that the library is progressive, e.g., circulation, book catalogs, serials holdings lists, etc.

(7) Selecting an application that will be least disrupting to normal operations, e.g., Harvard Shelf List and perhaps circulation.

There are variations of any of these reasons and, quite understandably, all of them tend to be practical.

We cannot state categorically that one approach to automation is better than another. Attempts are being made to generalize some of the work being done so that others may benefit from what has already been accomplished. Research and experimentation in automated systems are on the rise, and as time goes on these efforts will surely be successful in producing some much needed criteria.

It is much easier to talk about the concept of a total system than it is to accomplish it. Because there has been more talk than accomplishment--not at all uncommon in any new endeavor--the critics of library automation have been legion. Some of their criticisms have certainly been justified, but some appear to be made because of a lack of understanding. The most irritating thing is not so much what the critics say but the tone used to say it. What has been particularly disturbing is the apparent enthusiasm and eagerness with which some librarians await and accept all critical pronouncements. A worthwhile contribution these critics could make would be constructive suggestions rather than opinionated disapproval. One purpose of this entire report, and this section in particular, is to give some factual information about which librarians can make their own judgments. The rational and knowledgeable members of the "library automation community" are more aware than the critics that a greater semblance of order ought to be introduced into library automation by developing some basic criteria and guidelines. This can only be done by many groups working together, and that will take time. Progress is being made every day, but until such time as some theoretical bases have been developed, we must make the best use of the experiences of others.

REFERENCES FOR SECTION IV. A.

1. DeGennaro, Richard. "The Development and Administration of Automated Systems in Academic Libraries," Journal of Library Automation. I, March 1968. p. 75-91.

2. Kilgour, Frederick G. "Systems Concepts and Libraries," College and Research Libraries. XXVIII, May 1967. p. 167-170.

B. Summaries of Selected Library Systems

This part is devoted entirely to the actual work going on in a number of libraries throughout the country. Most of the data collected for each of these libraries was obtained by site visits. An effort was made to select libraries of different types and sizes as well as to show different approaches and techniques. It is hoped that some of their methodology and practices will be useful not only to libraries of similar type and size but to those operating in a different environment.

One must remember when reading the summaries that these libraries have faced the usual constraints and problems. They have had disappointments and in some cases have had to make compromises. They are the usual kinds of libraries and with a few exceptions have dozens of counterparts throughout the nation. They are not endowed with any extraordinary powers or privileges but seem to have used to good advantage the opportunities available to them. Some have had the good fortune to receive grant funding for initial planning and design, but their successes can be attributed more to careful planning and diligent effort than to outside financial assistance.

It has been two years since most of these libraries were visited and the data gathered. Since that time advances have been significant enough to alter the original notes and in some cases progress has been so great as to require a complete revision. By the time this report is published, there will be new data and more changes; but it is believed that the value of the summaries lies in the range of activities and environments represented and the different techniques and approaches used.

For convenience the sources of data for each library appear at the end of each individual summary and the libraries selected appear in alphabetic order as follows:

Cleveland State University Library

Cuyahoga County Public Library

George Institute of Technology, Price Gilbert Memorial Library

Harvard University, The Library

IBM Advanced Systems Development Division Library

Inforonics, Inc. - NELINET

Library of Congress

Los Angeles County Public Library

Los Angeles Public Library

Massachusetts Institute of Technology, Project INTREX

Michigan State University Library

Redstone Scientific Information Center

Rice University, The Fondren Library

System Development Corporation, LISTS Project

University of California--Nine Campuses

University of California--Institute of Library Research

University of California, Irvine, Library

University of California, Los Angeles, Biomedical Library

University of California, San Diego, Library

University of Missouri, The University Library

Veterans Administration, Library Service

Washington State Library

Washington State University, Holland Library

Yale University Library

CLEVELAND STATE UNIVERSITY
LIBRARY
CLEVELAND, OHIO

SUMMARY

Cleveland State University, formerly Fenn College, became a public-supported university in 1965. Prior to that time the Library's holdings were very limited in number and scope. The rapid growth in University enrollment and the urgent need to expand the collection and to improve the services led to the decision to design and implement a fully automated system.

The system consists of two phases: Phase 1, offline batch processing; and Phase 2, online real-time processing which will not be realized until the new building for the Library is completed. The acquisitions project is fully operational, and circulation is partial. The serial records project is in progress; cataloging is under study; and information retrieval not yet initiated.

Future plans call for completion of the above projects as well as conversion of library holdings into machine-readable bibliographic data and creation of a common data base.

I. Background

In 1965 Fenn College, a private commuter college originally sponsored by the YMCA, became Cleveland State University. The former Fenn College Library had a very modest collection in a limited number of disciplines--mostly engineering and business at the undergraduate level.

Since becoming a University, the Library has had to expand the collection, both in breadth and depth of coverage, to accommodate a rapid growth in student enrollment, the addition of many new courses, and the introduction of graduate programs. At the present time the Library has over 100,000 volumes, 2,000 periodical subscriptions, and thousands of non-book items in several locations on the Campus. Last year's budget for library materials and binding exceeded $300,000.

Because the growth of the University and thus the Library is much greater than normal and because the demand for better service is acute, the decision was made to proceed at once to the design and implementation of a fully automated system.

II. Objectives

The goal of the University Library automation scheme is to develop an integrated, computer-based automated system. The design features were initiated in September 1967, and the systems analysis follows traditional functions of a library--selection and acquisition, cataloging, circulation, serial records, and information retrieval.

The system consists of two phases:

A. Phase 1--Offline Batch Processing

This phase is designed to meet two basic objectives:

1. To meet the immediate needs of the library faced with difficulties resulting from rapid growth.
2. To establish an environmental background as well as a technical foundation for Phase 2 online operation.

The first phase must be dynamic to permit the transition from offline to online processing with minimum effort. The compatability of the two phases must be maximized to allow uninterrupted progress.

B. Phase 2--Online Real-Time Processing

The primary objective of Phase 2 is to afford the best service to library users by utilizing the fruits of modern electronic technology. This obligation will come closer to realization when Phase 1 becomes fully operational. Since some minimum physical requirements must be met before Phase 2 can be implemented, the transition from Phase 1 to Phase 2 will probably not be realized until the new library-faculty building is completed in 1970.

III. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

The Library has guaranteed access to the facilities of the University's Computer Laboratory, which houses an IBM 360/40 with 256K memory, tapes, and disks.

Equipment located in the Library and renting for about $1,200 a month includes:

3 IBM 029 keypunches
2 IBM 059 verifiers
1 IBM 88 sorter
1 IBM 519 reproducer
1 IBM collator
1 IBM 1030 data collection system with two input and one output station.

Except the operating system used with the computer, there has been no other software implemented for the purpose of library automation. All application programs are written in COBOL by the Computer Laboratory staff.

B. Personnel

Since the University believes that maximum efficiency can only be achieved by centralizing the data processing facilities and personnel, the Library requests services from the Computer Laboratory just like any other functional unit on the Campus. The number of staff assigned to the Library varies, depending on the availability of resources and the urgency of the request.

IV. Activities

The library automation system encompasses five projects in various stages of development. Each project may have one or more segments depending on its functional aspects.

A. Project 1, Acquisitions--Operational

Status:	Completed and turned over to Operations
Design:	100 per cent completed
Development:	This project consists of 37 programs, all of which have been completed.
Test:	No further testing pertaining to the project is currently conducted except minor program revisions due to functional changes, which are common to all systems.
Production:	This project is divided into four segments--ordering, vendor file maintenance, check-in and processing information, and fund accounting. The major programs of each segment are run weekly; others are run monthly.

B. Project 2, Circulation--Partial

Status: Partial production but not yet turned over to Operations.
Design: 85 per cent completed.
Development: This project encompasses three segments--charging and discharging, circulation file maintenance and statistics, and overdue notice and fine process. The programs pertaining to the first segment have been completed; others are still under development.
Test: Testing is conducted on newly developed programs.
Production: The first segment, which consists of three main programs and four supporting programs, has been running daily. The outputs are utilized by the circulation personnel in their daily work.

C. Project 3, Serial Records--in progress

Status: In progress.
Design: 50 per cent completed.
Development: The time required to collect the serial records data is a significant factor in the time required to implement the system. In order to meet the immediate needs of the Library without impairing the integrity of the project, it is segmented into four development stages: to establish and maintain a serial records file; to process serial renewal and new subscriptions; to check in serial arrivals; and to query library serial holdings. To date, one program has been completed.
Test: Testing will be conducted as soon as new programs are written.
Production: Since the entire project is still in developing stages, no regular production runs are scheduled. The only output at the present time is a quarterly listing of serial records.

D. Project 4, Cataloging--under study

Status: Under preliminary study.
Design: 1 per cent completed.
Development: In an effort to determine the cost and advantages of several catalog production alternatives, studies have been initiated on (1) MARC II tapes as a source of bibliographic information, and (2) book catalogs.

Because of the book selection policy, MARC II tapes serve only partial needs. The number of hits, e.g., selected book entries found on MARC II tapes, is estimated at 50 per cent. Perhaps the best policy will be to combine the use of the MARC II tapes with the order-history tapes. From the machine-readable catalog data, catalog cards and/or book-form catalogs can be produced, and production of an accessions list will be facilitated.

Test: Entensive testing has been done on MARC II tapes for usage feasibility study.

Production: No production schedule as yet.

E. Project 5, Information Retrieval--not yet initiated

Between January 1968 and June 1969 the following tasks and routines were automated: Vendor file, purchase orders, fund accounting, outstanding orders maintenance, book check in and processing, management information reports, circulation charging and discharging, serial listing, circulation statistic reports, overdue notices and fine process.

V. Future Plans

A. Completion of Serial Project.

B. Computerization of catalog production.

C. Transition from batch processing to online processing.

D. Conversion of library holdings into machine-readable bibliographic data.

E. Implementation of an information retrieval system.

F. Creation of a common data base.

VI. Sources of Data

Site Visits and interviews with Mr. John Hsu, Supervisor of Applications, Systems, and Programming, Computer Laboratory.

Summary submitted by Mr. Hsu, 1969.

CUYAHOGA COUNTY PUBLIC LIBRARY
CLEVELAND, OHIO

SUMMARY

The Cuyahoga County Public Library has used data processing equipment since 1965 to process book buying lists; to print invoices, book labels, book pockets, and shelf list cards; and to maintain controls and records in the Order Division. With a minimum of data processing equipment, the Library now processes books for its own 25 branches and 165 school libraries as well as for eight other public library systems and fifty boards of education representing 386 school libraries.

I. Background

The Cuyahoga County Public Library, the second largest county library system in the country, consists of 25 existing branches and two more being built and has a book stock of over a million volumes. It serves much of the suburban area around Cleveland including 165 school libraries.

CCPL was the first public library system in Ohio to use data processing equipment. Since automation began in 1965, it has contracted to process books for other library systems and school districts. Today, in addition to processing for its own branches, the Library processes books for eight other public library systems and fifty boards of education representing 386 school libraries. Total production exceeds 300,000 volumes a year for all systems.

II. Activities

A summary of operations explaining the development of the system was submitted by the Library (1). Portions are quoted as follows:

> Four years ago it became evident that CCPL must automate some of its processing routines. A Univac 1004 Card Processor was chosen to do the job. Peripherals consisted of the following IBM equipment: 026 Keypunch;

026/90 Interpreting Keypunch; 082 Sorter; 514 Reproducing Punch, and 085 Collator.

A total systems approach was not considered at the time; rather, we concentrated on the most pressing needs. Our main concern was to relieve Order Division's almost impossible task of accumulating book buying lists. Practicality overruled many other considerations and consequently we are still patching, especially in those areas which have been added to since our initial automating.

In October 1965 we ran our first application, the branch magazine order. We also printed a magazine holdings list. Along with this program we were accumulating the new adult book buying lists and producing outstanding Titles Ordered cards.

In 1966 more book buying lists were automated and our services were expanded to include schools buying books with government funds. NDEA and ESEA invoices were printed out on the 1004, as were encumbrances and cancellation notices. The 082 sorter was exchanged for a faster 083 model in December 1966 and a third keypunch was also added during the year. Computer utilization amounted to some eight hours per week.

In 1967 book labels, book pockets and shelf list cards were printed out on the computer, and the Univac 1004 was changed to a Univac 1005 with the addition of a card punch. The creation of a CCPL directory was the first new 1005 program. Computer utilization rose to 16 hours per week.

In 1968 a fourth keypunch was added to cope with the growing length of order lists and related work. The 1005 was again upgraded, this time with a read punch, enabling us to speed up general processing. Along with direct billing we also issued a revised list of Titles Ordered and a new form of cancellations. The 514 reproducing punch was returned to IBM, but a burster and carbon decollator were added to the division late in 1968. Computer time reached 20 hours a week, or some 900 hours per year.

Most of our bread and butter work involves the printing of book pockets and shelf list cards--over 1,000 a day. Our book pocket form went into its first revision in 1968, and the only problem with it has been a tendency to smear ink when the computer ribbon is fresh. The 1005 has a shortened programming and debugging time as well as a slightly greater capacity than the 1004.

During 1968 the Data Processing Division handled more than 90 buying lists comprising over 32,000 volumes each; 14,910 sets of book order master cards were punched for new titles.

It is time, however, to review the future potential of a card processing system. It is no longer adequate for the growing volume of work involved. Master card files grow and grow and cards can be easily misplaced or lost. Access to bibliographic storage is difficult or impossible to recover. Considering these disadvantages, tapes and disk packs are the only alternative to our growing problems (1).

III. Observations

CCPL has accomplished a great deal with a minimum of equipment and without excessive costs in time and money. The fact that they did not consider the total systems approach in the initial planning has caused some problems but not to the extent that the Library was forced to make major changes in scheduling and production. The Library adds equipment as it is needed and is reaching the point where it is outgrowing its present card system for storage.

IV. Sources of Data

1. Summary submitted by Mr. Frederick Davenport, Head of Technical Services.

2. Site Visits at various times. Interviews with members of the staff.

Personal Communication with Mr. Lewis C. Naylor, Director, and Mr. Davenport.

GEORGIA INSTITUTE OF TECHNOLOGY
PRICE GILBERT MEMORIAL LIBRARY
ATLANTA, GEORGIA

SUMMARY

The Georgia Institute of Technology is one of the major institutes of its type in the Southeast. Since no degrees are offered in the humanities or social sciences, the Library's holdings reflect a curriculum concentrating in science and technology. Besides serving the students and faculty, the Library offers extensive service to industry.

As one of the original participants in the MARC Pilot Project, the Library has used the MARC tapes from the beginning to produce catalog cards and to create a machine-readable MASTER FILE. Additional uses for the tapes are in various stages of development.

I. Background

The Georgia Institute of Technology offers no degrees in the humanities or social sciences. Restriction of the curriculum to courses in science and technology, except for a few survey and introductory courses, is reflected in the holdings of the Price Gilbert Memorial Library and in the Library's data processing requirements. The Library has one on-campus departmental library and does the technical processing for the Library at the Southern Technical Institute. The Library serves a student body of about 8,000, a faculty of 850, and is unusually active in serving industrial users.

The current Library budget is slightly under one million dollars. The collection numbers over one million items including over 500,000 volumes, 300,000 units of microtext, 52,000 maps, 32,000 pamphlets, 20,000 slides, and 8,000 phonorecords. Eleven thousand serial titles are currently received. In 1967-68, 14,500 titles (28,000) volumes were cataloged and 5,500 volumes were reclassified.

II. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

1. The Computer Center has a Burroughs 5500 and recently added a UNIVAC 1108--a very large computer. Both computers have disk storage and online capabilities. COBOL is being used for both the B5500 and the UNIVAC 1108.

2. The Library has keypunches and Flexowriters for use by the Library staff.

B. Personnel

The Library has had its own data processing staff, headed by the Data Processing Librarian, who works closely with the Computer Center to develop programs and procedures.

III. Activities

As one of the sixteen original participants in the MARC Pilot Project, Georgia Tech has used the MARC I tapes in actual operations since mid-1967, and will continue with MARC II tapes. An account of the Library's experience in the MARC Pilot Project appears in the Final Report (1).

A. MASTER FILE--Operational

At present the MASTER FILE is stored on magnetic tape and consists of all books added to the collection and all books reclassified from Dewey to LC--reclassification began July 1, 1966.

One record for each book added to the Library is taken directly from the MARC file if available; otherwise by original input after all cataloging is completed.

B. Catalog Card Production--Operational

1. If cataloging copy for a book is on the MARC file:

   a. A "Select" card is keypunched to extract the record from the MARC file and the record is added to a temporary file of additions to the MASTER FILE. Additions, changes, and deletions of data elements in the record can be made at the time of selection or later. At the time of selection or correction, a proof listing of the record is printed.

b. From the MASTER FILE additions, the card print program of the computer generates, sorts, and prints the required catalog cards--upper case only.

c. Data for the book card and book pocket are formatted from the MASTER FILE additions, output on punched cards, and converted to punched paper tape. From the paper tape, the Flexowriter prepares book card, book pocket, and spine label. The system was designed and programmed with this capability, but this particular feature of the system is not operational at present.

2. If cataloging copy for a book is not on the MARC file, a search is made for the LC deposit card or NUC entry; if neither is found, entry is prepared after original cataloging.

   a. Catalog cards, book card, book pocket, and spine label are prepared on Flexowriter.

   b. Punched paper tape from the Flexowriter is converted to punched cards which are input into the computer to update the MASTER FILE.

C. Book Catalog Preparation--Experimental

1. This experimental project is to test the feasibility and the economics of using book catalogs in the future.

2. Author, Title, and Subject print files are created from the MASTER FILE. At present cumulative monthly supplements are printed out. Weekly supplements are currently being produced experimentally but are not being distributed.

3. 200 copies of the new book list are produced each month.

D. Acquisitions--Planning

A program has been written to use the weekly MARC tapes as a selection aid to list new books in the subject areas of special interest to faculty members or library staff members who have responsibility for book selection in different subject areas.

IV. Future Plans

A. Book Catalogs

1. If Book catalogs are adopted:

    Data will be in machine-readable form with LC classification. The book catalogs will include entries for all titles classified by the LC classification. The card catalog will continue to be used for the other materials still classified by Dewey. As reclassification progresses, the titles will be added to the MASTER FILE and book catalogs. As soon as reclassification is completed, there will be a machine-readable record for each book in the collection.

2. There are no plans to put everything in one catalog. Perhaps there will be a five-year accumulation, but the final decision will depend on reactions of the users.

3. When printing and other output devices become less expensive, upper and lower case and expanded character sets will be considered. Although there has been no resistance to the use of upper case only, MARC II upper/lower case coding will be retained for possible use in the future.

B. Online Capabilities

1. A program is being developed to correct records online by using a teletype installed in the Library and connected to disks.

2. Eventually orders will be printed direct from the MARC files and all the data will be added to the "online process" file maintained on disks.

C. Serials

The Serials file contains holdings only at the present time; these records are stored on magnetic tape. The file is printed annually with cumulative monthly supplements between annual editions. The Library will not consider an order, check-in, and maintenance file until it can be handled online.

V. Cost Considerations

From the beginning detailed costs have been kept on catalog card production.

A. Although the Library has not been charged for use of the Burroughs Computer, it may be charged for the UNIVAC. It has been, therefore, wise for the Library to include time used on the Burroughs in calculating production costs--$140 per hour for processing and $47 per hour for Input/Output time.

B. Average catalog card production costs during the peak of activity March-August 1968, excluding development costs, were as follows:

	PER TITLE (average of 8 cards per title)	PER CARD
Computer Costs	38¢	4.8¢
Materials and Other machine costs	12¢	1.5¢
Labor	45¢	5.6¢
TOTAL:	95¢	11.9¢

This is somewhat cheaper than the old system.

C. Selection of titles from the MARC file was inexpensive when the file was small. With almost 50,000 records to be searched, it is now the most expensive computer operation, suggesting the need to reduce the file for more efficient operations.

D. The human element must be considered in batch processing. Proofreaders, in particular, do not like big batches of material at any one time. Although larger batches would reduce costs, 100-200 records at one time seem to be much more acceptable.

E. Consideration of cost versus need must be given when deciding the frequency of updating and merging records.

VI. Special Problems

A. Using MARC tapes

1. The Library is very dependent on MARC tapes. Delay in receiving MARC II tapes has caused a big backlog and necessitates preparation of more records by original input.

2. Conversion from MARC I to MARC II format requires new computer programs. Until these are completed, MARC II will be converted to MARC I format.

B. Hardware

1. Changing from the Burroughs 5500 to UNIVAC 1108 requires extensive reprogramming.

2. The drum printer gives only fair print quality, especially on card stock.

3. MARC I records required extensive proofreading and correcting which is very time consuming. MARC II is expected to have greatly improved quality control so that proofreading can be eliminated.

4. As suggested above, MARC tapes cannot grow indefinitely; some criteria must be formulated for retaining in the files only those records which are of interest to the Library. A statistical study should be made to determine the selection policy.

C. Personnel

High turnover of keypunch and Flexowriter operators, mostly because of low salaries and the transient status of the operators, i.e., wives of graduate students, requires spending too much time in training. The procedures were found to be too complex, and effort is being made to simplify both the procedures and instructions, thus shortening the training period.

D. MASTER FILE

Complications arise from using the MASTER FILE as the data base for both card production and preparation of the book catalog. A library producing only cards would have a much simpler operation.

VII. Sources of Data

1. Kennedy, John P. "Georgia Institute of Technology." In: The MARC Pilot Project. Final Report on a Project sponsored by the Council on Library Resources, Inc. Prepared by Henriette D. Avram. Washington: Library of Congress. 1968. p. 95-101.

2. Kennedy, John P. Presentation at MARC Institute, Cleveland, Ohio. February 11, 1969.

3. Site Visit in December 1967. Interview with Mr. John P. Kennedy, Data Processing Librarian.

Personal Communication with Mr. John P. Kennedy, 1969.

HARVARD UNIVERSITY
THE LIBRARY
CAMBRIDGE, MASSACHUSETTS

SUMMARY

The Harvard University Library is the largest academic library in the world. The age, the size, and the complexities within the Library have determined the approach to automation. The Library's philosophy is based on the practical approach of progressing a step at a time and producing useful products rather than making many radical changes in many areas at the same time.

The Library has engaged in automation projects since 1963. Its major and most original effort is the production of a computer-produced shelf list, converting the records class by class. As one of the original sixteen participants in the MARC Pilot Project, the Library has experimented in several areas with the MARC tapes. Other projects include the Punched Card Circulation System, which has been in operation since 1963; computer-produced lists of current journals in the Sciences; ordering and accounting procedures in Acquisitions; machine-readable supplements to the subject heading list; and machine-readable classification schedules.

Automation has become a permanent and accepted part of the Library's operations, and research and development programs will continue toward further implementation.

I. Background

Harvard University began as Harvard College, the oldest college (1636) in the United States. The University also has the largest academic library in the world. The Library of Harvard University, consisting of nearly 100 separate libraries, has a collection of over 8.0 million volumes and pamphlets.

The main collection is housed in three buildings: Harry Elkins Widener Memorial Library, which is the center of the library system and has a collection of 2.5 million volumes; Houghton Library housing the rare book collection and manuscripts; and Lamont Library serving the needs of undergraduates.

2

The Fine Arts Library is also considered part of the central collection, and there are a number of departmental libraries within the Faculty of Arts and Sciences. Over 300,000 books belonging to Harvard are stored in the New England Deposit Library nearby. The remaining four million volumes are located in professional schools and research institutions throughout the University. The largest collections are those found in the Law School, the Medical School (now in the Francis A. Countway Library of Medicine), the Baker Library of the Business School, the Chinese-Japanese Library, the Andover-Harvard Library of the Divinity School, the Littauer Library, and the Museum of Comparative Zoology.

II. Philosophy

The philosophy of the Library in regard to automation is a practical one. It differs somewhat from the expressed philosophy of some of the other libraries, but in actuality it probably expresses in succinct terms the approach being used in most of these other libraries. A frequently quoted and widely cited article by DeGennaro elaborates on this theme (2). In brief it is as follows:

A. The Library does not favor the "total systems" idea when it means attempting to make many radical changes in many areas at the same time. It is better to approach automation a step at a time and produce useful products along the way. Use of the computer should be made to pay.

B. Automation has become a permanent and accepted part of library operations at Harvard; it is no longer considered an *ad hoc* effort.

C. To become totally effective, all libraries sooner or later must have access to computer technology.

D. Large libraries, such as Harvard, should engage in continuing research and development programs and provide for such programs in their budgets.

III. Facilities for Automation--Hardware, Software, and Personnel

A. Hardware and Software

The Circulation Department of Widener Library has keypunches, a sorter, a reproducer, and a collator. The Data Processing Department has keypunches, Dura 10 paper-tape typewriters, and a paper tape to card converter.

A branch of the University Computing Center is also located in Widener and houses an 8K IBM 1401 with four tape drives and 120 character print chain. Because of the convenience, the

Library buys the time as needed and has most of the computer processing done on this equipment.

The Computing Center has had two large IBM 7094 installations, but within the past year one was replaced by an IBM 360/65. These computers are also used occasionally by the Library.

All programs are written in Autocoder. To experiment with the MARC tapes, a great many general and ad hoc programs have been necessary. To make it easier to write these programs, about thirty macro instructions (readily callable program modules) have been developed.

B. Personnel

Systems design and programming are done by librarians who have cultivated these areas and typically have the title "Systems Librarian." The Data Processing Division is under the direction of one associate university librarian; another works on special projects.

IV. Activities

This summary describes automation activities in the Harvard College Library, not the Harvard University Library as a whole. A more detailed account is given in DeGennaro's article, "Automation in the Harvard College Library" (1). Automation projects of the Countway Library of Medicine and the Baker Library of Harvard Business School are not included.

In keeping with the philosophy expressed above, automation has been approached a step at a time and useful products have been produced. Since 1963, implementation of the first project, the following projects have been undertaken:

A. Punched Card Circulation System

Because of the inadequacies and problems caused by a single manual file, a two-card punched card system for circulation was instituted in July 1963. Two complete files are maintained in the Library--an information file in a single sequence by call number filed in tubs behind the main circulation desk; and a transaction file broken down into numerous segments and kept in the book return room.

Since there are no book cards or pockets, readers make out their own cards as they have traditionally done. These are then keypunched and duplicated for the two files. Most of the processing is done within the department on the various pieces of unit record equipment. When printing is required for overdue lists, fine lists, etc., it is done on the 1401 maintained by the Computing Center on the ground floor of Widener.

The system has undergone minor revisions since the beginning, but the original plan is still being used. In September 1968 the card file in call number order was replaced by a magnetic tape which is updated and printed out in full five times a week. The punched card installation admittedly has limitations but has been much more effective than the former manual system in controlling circulation. A detailed account of the system including format, wiring diagrams, and programs appears in a paper by Palmer (7).

B. List of Current Journals in the Sciences

Circulation was the first project using data processing equipment of any kind, but the list of current science journals was the first project using computer output. This is a holdings list of over four thousand titles and is revised periodically.

C. Computer-Produced Shelf List

Preparation of a computer-produced shelf list is considered the Library's major and most original effort.

The 2.5 million volumes in the Widener Library are now represented by about two million entries, most of which are entered in a sheaf shelf list consisting of typewritten and handwritten sheets in looseleaf binders. This type of list is difficult to maintain, hard to read, inefficient, and error prone. It was never meant for the use of readers since there is only one copy located in staff areas not readily accessible to library patrons. On the other hand, it occupies less space than a card list and is easier to consult than a card file.

The advantages of converting catalog data to machine-readable form are apparent, but the task of converting the public catalog would take years, during which time the converted data would be of little or no value until the entire alphabet from A through Z had been completed.

To enter the catalog through the sheaf shelf list represents a new approach. By taking a few classes at a time and completing them, the Library has an entity for each class in machine-readable form. When a class is completed, the machine-readable records can then replace the sheaf shelf list for that class, and there are two hundred classes.

A pilot project using the smallest classification, the Crusades, was completed and judged successful. Although it consisted of only eleven hundred titles, it contained an excellent representation of handwriting, languages, and other problems likely to be encountered in most of the other classes.

Since then about twenty other classes have been completed or are in various stages of production. Each volume is computer printed, reproduced by photo-offset at 55 per cent reduction in size, and bound in book form. Nine volumes are printed in upper case only, and the remainder in upper and lower case. All are available for purchase.

To keep the "working copy" current, new entries are written in and the machine-readable record is prepared. In this way the Library staff always has an up-to-date "working copy" of the shelf list for each class. When needed, an updated book-form list can be printed.

The printed shelf list for each class consists of three parts:

1. The first part is a printout of the classification schedule which serves as an index or key to the second part. In the past readers have not had access to the classification schedules, which are so necessary for intelligent use of the shelf list.

2. The second part is a listing of the titles in the class in call number or classification sequence with class headings interspersed at the appropriate places. Parts one and two thus serve as a kind of classified catalog.

3. Part three is a printout in alphabetical sequence by main entry of everything in the class. This portion of the list is obtained by a programmed computer sort and provides a new approach to the titles in any given classification.

Admittedly the shelf list entries are not as complete as those in the public catalog, but they are in most cases adequate as a finding list or quick reference. They are intended to supplement rather than replace the subject approach to the public catalog.

Conceivably this same approach could be used to convert the dictionary catalog to machine-readable form. It is a known fact that much of the total use of a collection is centered in a small number of classes and the most active classes tend to be the most rapidly growing. By converting the shelf lists of the most active classes and creating machine-readable records for current accessions, one has the beginning of a machine-readable book catalog. If at any time more complete entries are desired for titles taken from the shelf list, additional data can be added to the existing record on the tape.

This new type of three-part shelf list has not only provided the reader with a new approach to the Widener collections but has also provided the staff with a more accurate and efficient inventory and classification tool.

This approach has been very beneficial for library operations. Since the original sheaf shelf list is used until replaced by a computer printout, there are no real deadlines. In the Data Processing section it is considered "bread and butter" work for the operators. They can be assigned other work at any time and return to preparing the shelf list when there are no other assignments. As a result, work is always available for the operators without the necessity for slowing down or speeding up.

DeGennaro's first article about the shelf list describes in detail its rationale and preparation (4). His second article, published after the Library had had considerable experience with the computer-produced shelf list, describes in more general terms the same basic strategy for converting the retrospective catalogs of the large research libraries into machine-readable form (3). Palmer's presentation at the Brasenose Conference considers the problems and possibilities for converting existing records in large libraries, with special reference to the Widener Library Shelf List (6).

D. Acquisitions

Use of the computer for ordering and accounting functions began in October 1967. What started as a relatively simple system has steadily been augmented until it now includes automatic conversion of foreign currencies, claiming of overdue items, detailed account listings in over 200 book funds on demand and statistical summaries of book selection activities by subject area.

E. Supplements to Subject Headings

In 1964 a list of Harvard subject headings was prepared by Listomatic Camera. Since then the supplements have been produced on the computer--cumulative every three months. Eventually the entire list of subject headings will be computer produced.

F. Classification Schedules

Harvard has its own classification scheme and own rules for main entries. All classification schedules are being revised, updated, and put into machine-readable form.

G. The MARC Project

As one of the original sixteen participants in the MARC Project, the Harvard University Library used the MARC tapes primarily for experimentation. The major focus was directed toward preparation of indexes to the MARC tapes. For example, a personal name index was prepared to use instead of the less satisfactory author-title listing supplied with the MARC tapes.

Although the Library encountered the not unexpected constraints and problems, and although the direct value of the MARC tapes to Harvard Library operations is limited at the present time, the experience gained has been valuable and important. Participation in the Project has shown the feasibility of receiving machine-readable bibliographic data from another library, making selections from the data, and reformatting the records as desired.

A more detailed account of the Library's experiences with the MARC tapes appears in the MARC Pilot Project Final Report, in which Palmer states that Harvard's chief reward for participating in the Project was gaining facility in manipulating machine-readable bibliographical records (5).

H. Special NSF-sponsored Study

As part of the Library's research program, a study was conducted to compare the efficiency and cost of paper-tape input (using the Dura Mach-10 paper-tape typewriter as is used by the Library of Congress for the MARC records) with the IBM 029 keypunch (used in Widener's shelf list conversion project).

The results were as follows:

1. Production

Dura input is about one-third faster than keypunching, but the equipment is more costly and complicated. The production of three Dura operators therefore equals the production of four keypunch operators. Furthermore, upper and lower case input is much easier to handle on the Dura. On the other hand, punched cards are much easier to correct.

2. Costs

At the end of the study costs of the two methods were found to be about equal for equal production.

3. Procedures Adopted

The keypunch and Dura systems are now operated in parallel. Since the available computer does not read paper tape, a special tape-to-card converter is used. Cards, whether originally keypunched or derived from paper tape, are put onto magnetic tape and printed out for machine aided editing. Cards are used to make the corrections necessary to derive a final magnetic tape from the preliminary one.

V. Sources of Data

1. DeGennaro, Richard. "Automation in the Harvard College Library," Harvard Library Bulletin. XVI, July 1968. p. 217-236.

2. DeGennaro, Richard. "The Development and Administration of Automated Systems in Academic Libraries," Journal of Library Automation. I, March 1968. p. 75-91.

3. DeGennaro, Richard. "A Strategy for the Conversion of Research Library Catalog to Machine Readable Form," College and Research Libraries. XXVIII, July 1967. p. 253-257.

4. DeGennaro, Richard. "A Computer Produced Shelf List," College and Research Libraries. XXVI, July 1965. p. 311-315.

5. Palmer, Foster M. "Harvard University Library." In: The MARC Pilot Project. The Final Report on a Project Sponsored by the Council on Library Resources, Inc. Prepared by Henriette D. Avram. Washington: Library of Congress. 1968. p. 103-111.

6. Palmer, Foster M. "Conversion of Existing Records in Large Libraries, with Special Reference to the Widener Library Shelflist." In: Brasenose Conference on the Automation of Libraries held in Oxford, England, June 30-July 3, 1966. John Harrison & Peter Laslett, ed. London: Mansell, 1967. p. 67-77.

7. Palmer, Foster M. Punched Card Circulation System for Widener Library--Harvard University. Cambridge, Mass.: Harvard University Library. 1965. 20 + p.

8. Site Visit in November 1967. Interviews with Mr. Foster M. Palmer, Associate University Librarian, and Mr. Richard DeGennaro, Associate University Librarian for Systems Development.

Personal Communication with Mr. Palmer, 1969.

IBM ADVANCED SYSTEMS DEVELOPMENT DIVISION (ASDD)
LIBRARY
LOS GATOS, CALIFORNIA

SUMMARY

The total systems plan for the Library at the Advanced Systems Development Division of International Business Machines Corporation, Los Gatos, California, is divided into three phases. Phase I, mechanizing the recordkeeping procedures for monographs and serials, is operational.

By capturing the bibliographic information correctly and completely at the initial entry, the system is able to handle ordering, cataloging, preparation of book catalogs, and circulation; to monitor all processes; and to provide a variety of printouts and statistics for both monographs and serials. Using an equipment configuration which combines online entry with batch processing, the Library is able to use the machine-readable information repeatedly for numerous purposes.

This summary gives the status and the plans of the Library as of January 1968.

I. Background

The Library serving the Advanced Systems Development Division of IBM at Los Gatos, California, would probably be considered a small, special library, but the scope of its collection is unusually broad and the services rendered are very personal.

The original ASDD Library in San Jose was a pioneer in the use of data processing equipment for ordering, routing, book catalogs, circulation, and subject searching. Based on the experience gained at San Jose, the new ASDD Library in Los Gatos, opened in 1964, was based on a total systems concept. Griffin's paper in the 1963 Clinic Proceedings of the University of Illinois details these early applications (1).

Because the Library is within a company which is a leader in the research and manufacture of data processing equipment and because it serves the area of advanced systems development, this particular Library has a unique opportunity to draw on the technology and technical assistance not available to most libraries. Nevertheless, the Library is an operating department and as such has the obligation and responsibility to plan and implement an effective and efficient system.

The total systems concept has been planned for the Los Gatos Library but is sufficiently flexible to meet a variety of needs in any library.

II. Objectives

The Library goals for an integrated system are:

A. To establish control at the time of original entry by capturing bibliographic information correctly and completely.

B. To speed the flow of processing.

C. To reduce errors at the time of input.

D. To provide computer assistance in indexing.

E. To provide faster retrieval of information.

F. To take the library to the user--the most important objective toward which all the other objectives are focused.

III. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

1. IBM Administrative Terminal System (ATS)

A typewriter terminal located in the Library is linked to an IBM 1460 Data Processing System with disks for bibliographic input. An IBM 7090 Data Processing System is used for processing and sorting, and an IBM 1401 Data Processing System (12,000 storage positions) with four tape drives for printing and punching. These three systems work together to provide the necessary records and controls for the Library.

In the near future an IBM 360/40 online system will replace the IBM 1401-7090 system.

2. Software

Programs for the IBM 7090 are written in COBOL. Autocoder is used for the IBM 1401; these programs can also be run on the IBM 1460.

Computer programs are designed to be machine independent so that equipment configurations other than the one mentioned above can be used.

B. Personnel

A programmer is assigned to the Library, but others on the Library staff are also familiar with the routines and procedures.

IV. Activities

In order to capture bibliographic information correctly and completely at initial entry (ordering), this total system utilizes direct online communication with the computer. The total system is divided into three phases for implementation. At this time Phase I is operational.

A. Phase I: Mechanizing the Recordkeeping Procedures--Operational

Initial data are entered into the computer through the IBM Administrative Terminal System (ATS) typewriter linked to an IBM 1460 Data Processing System with disks. It is later transferred to punched cards and magnetic tape for processing in batches.

Since Phase I is described in detail in the Library Procedure Manual (2) and the IBM Data Processing Application Manual (3), a brief account is given here.

1. Monographs (Books, Reports, Pamphlets)

a. Acquisitions--Ordering

As much pre-cataloging as possible is done before an item is ordered.

The initial request is made on an Order Card, of IBM card size, filled in by the requester and completed in the Library.

After the decision to order is made, the information is transferred from the card to a worksheet. The worksheet serves as the copy for the operator to enter the information online via the ATS typewriter to the 1460 system to be placed in working storage on a disk. At the end of each day, after the stored records have been verified, the computer punches the information onto cards. The resulting packet of cards for each document is called the Initial Order Packet, which can be used to print a listing.

After all errors are corrected, the data from the cards are transferred to the Order Master File stored on magnetic tape in preparation for the order run. This order file can be updated and run as often as necessary--weekly, semi-weekly, daily, or whatever schedule is most practical for the Library.

Although all orders are included in the Order Master File and are therefore in machine-readable form, only blanket orders are printed by computer. Vendor information for computer-printed orders is taken from the Vendor Master Tape. The Vendor Master Tape includes names, addresses, and other pertinent information about vendors.

At the time the order forms are computer printed, a C card is punched. This card is held until the item is received or the library is notified that the item is not available; at that time it is submitted to the computer to update the record. Special codes can be used to record specific receipt problems, e.g., received the invoice but not the item.

This part of the system is also capable of notifying the librarian of expended, encumbered, and unexpended funds; of reminding the librarian to order proceedings and other items published on a periodic basis; and of printing claim notices automatically for overdue items.

When the Order Master File is updated, the computer prints out summary totals of new orders processed, items received which are correct or with problems, items returned to vendor, outstanding periodical orders, and total outstanding orders. The computer also maintains certain records which can be printed on request, e.g., vendor balances.

b. Accessions Processing

As part of acquisitions, accessions processing includes the final procedures necessary to place an item in the library holdings.

After the document arrives, the ATS typewriter is used to update and correct the order records for price and any new bibliographic information. Corrected cards are then punched and merged with the cards of the Initial Order Packet to become the completed Source Deck.

The Source Decks are read onto magnetic tape to product a supplement tape to the Master Accessions File which contains all the information recorded for each book or report. The supplement tape is used to print a listing of new items for the Library daily newspaper. At the same time circulation cards and the spine and pocket labels are made.

c. Book Catalogs

The Library has replaced the card catalog with nine separate book catalogs which the computer sorts and prints from the information in the Master Accession Tape File.

These catalogs are:

(1) Author Book Catalog

(2) Title Book Catalog

these do not include publisher, place, or subject-descriptors

(3) Subject-descriptor Book Catalog

(4) Call Number (Shelf List) Catalog

This catalog contains the complete bibliography entry, such as the Library of Congress shelf list card, except that the collation is omitted.

(5) Author Report Catalog

(6) Descriptor Report Catalog

(7) Report Number Catalog

(8) Accession Number-Report Number Catalog

(9) Accessions Catalog

Each of the above contains minor modifications.

A supplement for each catalog is printed at each updating of the Master Accessions File. Supplements are cumulative until the complete comprehensive catalogs are printed every six months.

Catalogs are automatically weeded. Reports are removed and stored in an inactive file after four years, periodical articles after 18 months, and most books after five years.

d. Daily News Listing

As part of the daily newsletter, a list of new books and reports and new periodical articles of interest is prepared on the ATS typewriter and printed on the computer.

e. Circulation

The circulation system is designed to keep track of books and reports, to maintain reserve request files, to produce inventory and termination notices, to provide immediate check in for all items, and to provide records of book use.

A set of prepunched IBM cards is in each book and personnel borrower information is stored on magnetic tape. Computer programs handle these two input records, and the system output provides circulation and reserve request listings, inventory and termination notices, reserve requests, and new circulation card sets.

During accessions processing the computer punches five circulation cards for each new document. When an employee borrows a book or report, he enters his personal data on one of the circulation cards. This information and a special code are keypunched into the card; the card is read onto magnetic tape and merged with the existing Circulation Tape File in man-number order. This tape and the updated personnel file are merged to produce a third tape with complete circulation information about each newly borrowed item. After being sorted into author order, it is merged with the Master Circulation File and the daily circulation listing is printed out. The list includes author, title, and call number of item; borrower information; date; and number of requests placed for the document.

When a document is returned, one of the pre-punched circulation cards is pulled from the book pocket and submitted to the computer to erase the record in the circulation file.

Reserve requests, notification of present borrower, and overdue notices are also handled by the system. As desired, the computer prints a listing of all items on loa [illegible] each borrower.

2. Serials

The serials processing system is designed to keep track of periodicals received, to print claims of those not received, to handle routing, to order indexes when needed, to prepare bindery labels and lists at the appropriate time, to remind the librarian to renew subscriptions, and to print an accurate holdings listing on demand. In addition, the system keeps track of other regularly issued serials such as annuals and proceedings by providing the librarian with an order card prior to order time.

Many of the processes for serials are similar to those for books and reports. A requester uses an order card to make a request, and the librarian fills out a serials worksheet. This information is entered online to the computer through the ATS typewriter. Cards are punched by the computer and processed along with the books and reports as part of the order processing system. Unlike books, serials always remain on the on-order tape for re-ordering purposes.

At the time of ordering, a C card, such as is prepared for each book, is punched for each periodical to be received during the year. In addition a K 01 card is punched and used to check in the first issue of a periodical.

On arrival of the first issue, the C card is submitted to the order file to change its status and the K 01 card plus the periodical packet of cards is read onto the Periodical Accessions Master File. The computer then produces the following listings and/or cards for use in the library system:

a. Audit list, a complete entry for every periodical, serial, and "see" entry (listing obtained on request).

b. Union list in alphabetic order by title, giving holdings, language, and Coden (on request).

c. Subject list (on request).

d. Coden list (on request).

e. Accession list (on request).

f. Want listing of missing issues (on request).

g. Issues received list, for the daily news listing (on request).

h. Routing slips (on request).

i. Check-in cards for each title received for the first time; a K card is produced for each issue the Library expects to receive during the year.

j. Request-for-claim cards (RC1 card).

k. Request for purchase order, including expiring subcriptions, recurring items that are ready to be ordered, and indices (OP1 card).

l. Error messages.

m. Console sheet stating statistics for the total number of subscriptions, number of check-in cards in that run, and number of new subscriptions.

Enough K (check-in) cards have been produced for each title to cover the issues expected during the year. As issues arrive daily, K cards are pulled and used to produce the "issues received list" in the daily newsletter and to update the Periodical Accessions Master File.

In addition to updating the Periodical Accessions Master File, the program is capable of punching check-in cards for new or renewed periodicals, printing routing slips, punching request-for-purchase-order cards for expiring subscriptions.

Triggered by one of several kinds of changes, the computer provides the following output for the librarian: bindery request listing, bindery order cards, and bindery tickets.

When a periodical is checked out, the employee fills in his name, department number, and date on the card inside the periodical. This card can be filed manually by title, if periodical circulation is not extensive.

Phase I of the system has proved efficient for streamlining processing and providing stricter control. It also yields valuable statistics for improved operations.

B. Phase II: Using an IBM System/360 for Real-Time Searching--Future

When an IBM System/360 is available to the Library, real-time bibliographic searching using an IBM 2260 Display Station will be possible. The user will be able to enter his request online in natural language.

Searches made for the preparation of lengthy bibliographies will continue to be batch processed.

C. Phase III: Converting Phase I Recordkeeping to the IBM System/360 --Future.

V. Sources of Data

1. Griffin, Marjorie. "IBM Advanced Systems Development Library in Transition." In: Proceedings of the 1963 Clinic on Library Applications of Data Processing. Herbert Goldhor, ed. Urbana: University of Illinois Graduate School of Library Science. 1964. p. 79-95.

2. IBM ASDD Library Procedure Manual. Coordinated and edited by Vilia Ma. International Business Machines Corporation, ASDD Los Gatos Laboratory, Los Gatos, California. October 1967. 1 vol. (various pagings).

3. Mechanized Library Procedures for the IBM Advanced Systems Development Division Library, Los Gatos, California (E20-0285-0). White Plains, New York: IBM Corporation, Technical Publications Department, July 11, 1967. 82p.

4. Site Visit in January 1968. Interview with Mrs. Marjorie Griffin, Library Manager.

Personal Communication with Mrs. Griffin, 1969.

VI. Addendum

Since this summary was written, several changes have taken place. The computer is now an IBM 360/50, not dedicated; and there are three IBM 2260 video consoles located in the Library, one of which is at the Reference Desk for the use of librarians and patrons. Ordering/receiving and cataloging are now online, but the book catalog is retained for use after 8 p.m. Circulation and serials are handled by batch processing but will eventually be online.

INFORONICS, INC. and NEW ENGLAND LIBRARY NETWORK (NELINET)
CAMBRIDGE, MASSACHUSETTS

SUMMARY

The New England Library Network (NELINET) is comprised, at the present time, of six New England state universities--Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

The network has two unusual features: First, design and development are being done by Inforonics, Inc., a private organization; and second, the network is a computer-based regional cataloging and processing center for the six universities rather than the more common reference-type network. Work progresses in phases, and the network is now partially operational with a full-time director.

I. Background

Inforonics, Inc. is a private organization engaged in research, consulting, and contract work related to libraries and information services. It offers a wide variety of services which include systems analysis, study of hardware and software, programming, production of indexes and abstract journals, design and development of operating systems, technical services for libraries and information centers, and special studies related to these activities.

An early study made by Buckland for the Library of Congress was concerned with the conversion of library catalog card data into machine-readable form and the feasibility of encoding Library of Congress card data for computer operations (2). Other special studies made by members of the staff of interest to libraries include mechanization of filing rules (6) and compression techniques for word coding which can be used for retrieving information from large data files (3).

II. New England Library Network (NELINET)

A major and unusual project that Inforonics has undertaken is the design, development, and implementation of a network consisting of the libraries of six New England state universities--Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont.

The concept of this cooperative effort, sponsored by the New England Board of Higher Education, is that each library shares its cataloging and bibliographic information through one computer-based technical processing center. Whereas most library networks are viewed as an expansion of reference services to library patrons, this network supports the operating functions of libraries. Ultimately, when sufficient bibliographic data are available in machine-readable form, the network can also serve reference functions.

The network is being developed in phases and is now partially operational with a full-time director. An article by Vincent (7) lists ten basic services that the network will eventually provide: (1) machine catalog data file creation and maintenance, (2) catalog data file search and retrieval, (3) production of conventional catalog card sets with LC call numbers and overprinted headings, (4) book pocket labels, (5) book labels, (6) book form catalogs as requested, (7) shelf list maintenance for each library, (8) input for local circulation control systems, (9) acquisition control, and (10) maintenance of subject authority files and cross references keyed to local collections.

The same article also gives the three tasks necessary to provide these services: (1) Task One--to create a catalog data file in machine form, using information provided by current library acquisitions, reclassification programs, and Project MARC; (2) Task Two--to provide cataloging information for each library's new acquisitions and reclassification projects by searching the catalog data file created in Task One; and (3) Task Three--to exploit the catalog data file for acquisitions searching and control.

Within each task computer programs must be developed, machine configurations selected, and testing performed. Scheduling has been such that tasks overlap, and services have been added as the capability for providing them have become available.

Design of the network includes both batch processing and online time-sharing services. Searches of the computer-stored catalog file in support of acquisitions and cataloging operations are now batch processed for preparation of purchase orders, catalog cards, pockets, labels, etc. At a later time searching will become an online operation.

An interesting study on the overlap of the collections in the six libraries was made in connection with this project and reported by Nugent (4). The data were needed to predict the degree of joint use of cataloging information and to estimate the efficiency of collective reclassification. The results revealed a high degree of commonality (over 40 per cent); current imprints are expected to yield a higher percentage.

The philosophy of the project is to begin work in one area and to bring it to a certain point before adding another. Design of the project is such that in the future other academic institutions, both public and private, within the region could be served both for technical processing and for reference services.

A report by Nugent (5) and a progress report by Agenbroad, et al. (1) give further details on the project's development.

III. Sources of Data

1. Agenbroad, James E.; et al. NELINET--New England Library Information Network. Progress Report. July 1, 1967-March 30, 1968. Cambridge, Massachusetts: Inforonics, Inc. April 5, 1968. 2 vols. (various pagings).

2. Buckland, Lawrence F. The Recording of Library of Congress Bibliographical Data in Machine Form. Maynard, Massachusetts: Inforonics, Inc. November 23, 1964 (revised February 1965). 54p.

3. Nugent, William R. "Compression Word Coding Techniques for Information Retrieval," Journal of Library Automation. I, December 1968. p. 250-260.

4. Nugent, William R. "Statistics of Collection Overlap at the Libraries of the Six New England State Universities," Library Resources and Technical Services. XII, Winter 1968. p. 31-36.

5. Nugent, William R. "NELINET--the New England Library Information Network." In: Congress of the International Federation for Information Processing (IFIP). 4th Edinburgh, 5-10 August 1968. Proceedings. Amsterdam: North-Holland Publishing Co. 1968. p. G28-G32.

6. Nugent, William R. "The Mechanization of the Filing Rules for the Dictionary Catalogs of the Library of Congress," Library Resources and Technical Services. XI. Spring 1967. p. 145-166.

7. Vincent, Donald E. "New England State University Libraries' Regional Processing Center," ALA Bulletin. LXI, June 1967. p. 672-673.

THE LIBRARY OF CONGRESS
WASHINGTON, D. C.

SUMMARY

The Library of Congress is one of the largest libraries in the world and the largest of the three national libraries in this country. Its automation activities are not only of widespread interest but also have a direct effect on the operation of libraries in this country and abroad.

After several years of intensive study and deliberation, the central bibliographic apparatus was singled out as the area to be given first consideration in the automation program. The largest single project within this broad area, and the one best known to librarians, is Project MARC (Machine-Readable Catalog), the conversion of LC catalog card content into machine-readable form. Initial studies related to MARC began just over four years ago. A MARC I format was developed and tested in the MARC Pilot Project, an experiment in the weekly distribution of magnetic tapes containing current machine-readable cataloging data. The Pilot Project ran from November 1966 to July 1968. Based on further study and discussions and the experiences of those receiving the weekly tapes, the MARC II format was developed and has now been accepted as a national library standard for machine-readable catalog data.

In March 1969 the Library began the MARC Distribution Service. Magnetic tapes of current cataloging data are distributed to subscribers on a regular schedule. At the present time the tapes include only English language monographs, but foreign languages will be added at a later date.

There have been several special studies made in conjunction with the MARC Project such as development of a special character set and an analysis of bibliographic data conversion costs. In addition there are other projects connected with the study of the central bibliographic apparatus which are in varying stages of development. These include the National Serials Data Program; the Retrospective Conversion (RECON) Project; the use of the MARC II format and the MARC system in the Geography and Map Division and for Legislative Reference Services; and conversion into the MARC II format of GPO's machine-readable tapes for printing the 7th edition of LC's subject headings. Considerable effort is being expended in developing new software and in improving present operating computer programs.

The Library maintains continued cooperation with such national groups as COSATI and USASI and the national library associations. It is also working closely with the National Library of Medicine and the National Agricultural Library in the United States National Libraries Task Force on Automation and Other Cooperative Services.

I. Background

The Library of Congress needs no introduction to librarians everywhere. As one of the largest libraries in the world and one of the three national libraries in this country, its activities in any area, including automation, are not only of widespread interest but also have a direct effect on the operations of libraries in this country and abroad.

Whatever problems other large research libraries face in processing vast quantities of materials are multiplied many times within the Library of Congress. With upwards of 55 million items in its present collection and acquisitions numbering hundreds of thousands each year, the need is obvious to seek better ways for processing its own materials and to utilize the capabilities of the most modern technology available at any given time.

At the same time, the Library has the additional responsibility of serving the libraries throughout the country by providing a range of services and by seeking better means of communication.

Study and discussions pertaining to automation began as early as 1958 by an internal committee of the Library of Congress. As a result of the committee's efforts and some brief studies made by three computer firms, the Library took the stand that it was not immediately concerned with mechanizing a few operations but needed a blueprint for action during the next five to ten years. Creation of an in-house group responsible for the Library's activities in the field of automation and a comprehensive study to be made by an outside group were considered desirable first steps.

The Office of the Information Systems Specialist was created within the Library in March 1961. In December 1965 the name was changed to Information Systems Office (ISO) and the staff was greatly expanded. From the beginning this Office has had the responsibility for all projects related to automation and operates as a separate unit in order not to interfere with the Library's day-to-day activities.

Also in 1961 the Library secured a grant from the Council on Library Resources, Inc. for a study to consider the practicability and advisability of applying mechanization to the total bibliographic system of a large research library. The approach used for the study was a survey conducted by a team of outside specialists assisted by the staff of the Office of Information Systems Specialist.

From 1961-63 the staff of the Office assisted the survey team in the "Study of Possibilities of Mechanization in Large Research Libraries." The work of the team, headed by Gilbert W. King, Director of Research of IBM, culminated in January 1964 in the publication of its final report, the well-known Automation and the Library of Congress--often referred to as the "King Report" or the "King Survey" (16). Because of the interest generated by the report and the subsequent action taken by the Library of Congress in its automation program, Automation and the Library of Congress should be considered a significant document in library automation literature.

In 1963 the Library also co-sponsored a conference with the National Science Foundation and the Council on Library Resources, Inc., resulting in the publication in October 1964 of Libraries and Automation (26). These proceedings include an enormous amount of information on equipment, file organization, applications, implications, and opinions which are relevant to the automation of libraries.

From the beginning of the automation program at the Library of Congress, the staff of the Library has been extremely conscientious in reporting the progress of all projects. Because the details have been well documented in readily accessible reports and journal articles, this report attempts only to give an abbreviated account of the program and to indicate relevant references.

II. Findings of the Survey Team

The conclusions and recommendations reported in Automation and the Library of Congress have become the basis for much of the work now in progress at the Library. Specific conclusions reached by the survey team are as follows (16, p.2):

1. Automation can, within the next decade, augment and accelerate the services rendered by large research libraries and can have a profound effect upon their responsiveness to the needs of library users.

2. Automation of bibliographic processing, catalog searching, and document retrieval is technically and economically feasible in large research libraries.

3. The retrieval of the intellectual content of books by automatic methods is not now feasible for large collections, but progress in that direction will be advanced by effective automation of cataloging and indexing functions.

4. Automation will enhance the adaptability of libraries to changes in the national research environment and will facilitate the development of a national library system.

5. Automation will reduce the cost-to-performance ratio; however, the Library should aim at the expansion of services rather than the reduction of total operating costs.

Among the most pressing problems that face a large research library such as the Library of Congress are those pertaining to bibliographic organization and control. The King Report suggests that the immediate objective of automation be directed to solving these problems. But, as the report points out, "In the long run, however, the most significant effect of automation will be the focusing of the services of the library on the individual user for the optimal satisfaction of his research needs. Ideally an automated system should place the full resources of the library at the immediate disposal of the user" (16, p.2-3).

The report further identifies both short- and long-range benefits; the short-range pertaining for the most part to LC's internal operations and the long-range more directly related to its role as a national library responsible for supporting nationwide endeavors.

The report has provided much of the impetus for subsequent activities in connection with automation at the Library of Congress.

III. Development of a System

In translating the general conclusions and recommendations of the King Report into action, the central bibliographic apparatus was singled out for first consideration. The Library administration decided that the study and implementation of automation should be undertaken in reasonable segments.

Many of the details regarding the goals, philosophy, and approach for central bibliographic control are given in Markuson's 1966 article, "A System Development Study for the Library of Congress Automation Program" (25). An updated account appeared a year later in "The Library of Congress Automation Program" (23).

Since the total automation program related to the central bibliographic apparatus is complex, and since study and implementation are being undertaken in reasonable segments, many separate projects are going on simultaneously and are in various stages of development. The largest single project and the one best known to librarians is Project MARC (Machine-Readable Catalog), which has now advanced to the operational stage.

IV. Project MARC (Machine-Readable Catalog)

In March 1969 the Library of Congress began the MARC Distribution Service. This service climaxes the very intensive efforts of many people--librarians, systems analysts, programmers, etc.--to distribute LC catalog data in machine-readable form on a regular basis.

Of particular interest to libraries is the seemingly changing emphasis and importance given to certain aspects of Project MARC during the past four years. In the beginning, the concept of producing machine-readable cataloging directed primary attention to the distribution of records from a central source, i.e., the Library of Congress, to the library community, in addition to providing a data base for the Library of Congress.

As Project MARC advanced, certain significant events occurred. For example, the United Kingdom MARC Pilot Project experiment was begun. It became increasingly apparent that the greatest contribution a standardized machine-readable catalog format could make to others is to serve as an instrument for the exchange of catalog data or the communication among institutions.

The Library continues to regard its own needs with the same serious concern it has had from the beginning; and in the course of achieving its internal objectives, it has included the other half of its dual responsibility--that of serving other libraries--in its long-range plans.

As a result of the intervening events that have caused a revision in the initial concept of machine-readable cataloging data, libraries now have available to them a powerful tool for the exchange of bibliographic data.

An interested observer cannot help but be impressed by the speed, alacrity, and selfless dedication with which a multitude of tasks have been accomplished. Project MARC, as one part of the total automation program, is a very large undertaking in itself and is indicative of the amount of detailed work inherent in a large-scale project. Initial studies leading up to MARC began just over four years ago, and within this relatively brief period an acceptable format has been developed and an experiment to test the feasibility of distributing LC catalog data in machine-readable form on a regular basis has been completed.

A. Development of a Format

1. MARC I

Because of the widespread interest of the library community in the conversion of cataloging data to machine-readable form, the Council on Library Resources, Inc. sponsored a study in 1964 to determine possible methods of converting LC catalog card content to machine-readable form for the purpose of printing bibliographical products by computer. The study, conducted by Inforonics, Inc., resulted in a report, "The Recording of Library of Congress Bibliographical Data in Machine Form" (9).

This report served as the basis for the first conference held in January 1965. As a result of the conference, three Library of Congress staff members were assigned to conduct a study for the analysis of cataloging data from a machine-processing point of view. The result of the study was a report, "A Proposed Format for a Standardized Machine-Readable Catalog Record (ISS Planning Memorandum No. 3), which was widely circulated (8). Library specialists throughout the country studied the report and commented on the proposed format and the use of such a record in individual libraries.

A second conference, sponsored by the Council on Library Resources, Inc., was held in November 1965, bringing together representatives of different types of libraries. These discussions and the great interest expressed by the library community strengthened the belief that the Library of Congress should conduct a pilot project for the distribution of machine-readable cataloging data as soon as possible. In December 1965, the Council on Library Resources, Inc. awarded a grant to the Library to initiate the project.

As a result of the two conferences and the opinions and suggestions of many other librarians within and outside the Library of Congress, the MARC I format was completed and used in the MARC Pilot Project.

2. MARC II

During the MARC Pilot Project, the Library of Congress, participants, and other interested libraries had an opportunity to study and evaluate the design and content of the MARC I format. Based on their evaluations and experiences, some major revisions were made and incorporated into the MARC II format.

Development and implementation of the MARC II format represented a great step forward toward a national library standard for machine-readable catalog data. The format has now been accepted as a national library standard by the American Library Association (ALA), the Special Libraries Association (SLA), the Committee on Scientific and Technical Information (COSATI), the Association of Research Libraries (ARL), the Federal Library Committee, the National Library of Medicine (NLM), the National Agricultural Library (NAL), and the British National Bibliography (BNB).

The designers of the MARC II format have attempted to develop a format structure which is hospitable to all kinds of bibliographic information and acceptable as a standard for interchange among libraries. Also incorporated in the design is the provision for handling the special requirements of individual libraries.

The MARC II format, even with its limited use, appears to be flexible and capable of serving a variety of library functions and of accommodating a wide data base. The serials format working document is now in print (32). A pilot map format has been designed and is in use. Progress is being made with the Audio-Visual (non-book form) format.

B. MARC Pilot Project

The initial specifications of the MARC Pilot Project were formulated between December 1965 and February 1966, following the award of a grant by the Council on Library Resources, Inc.

Sixteen libraries were chosen to participate in the experiment, and they began receiving weekly MARC tapes in November 1966. The experiment was initially planned for six months but continued until July 1968 at the request of the participants.

When it became apparent in mid-1967 that a MARC II format was forthcoming, changes were made in the computer programs. Activity during this brief transition period (October 1967 - July 1968) is referred to as the "Interim MARC System."

Experiences gained within the Library of Congress and the feedback from the participating libraries and many secondary users have been invaluable in providing a national standard for bibliographic description and in providing the feasibility of distributing machine-readable catalog data on a regular basis.

The documentation in connection with the MARC Pilot Project has been extensive and detailed; selected citations appear at the end of this summary, including the final report (1).

C. MARC Distribution Service

In March 1969 the Library of Congress began the MARC Distribution Service on a regular schedule. The initial service included only English. In July 1969 the coverage was expanded to include all English language monographs; foreign languages will be added at a later date. As of July 1969, there were 65 libraries subscribing to the magnetic tapes of the MARC Distribution Service.

V. Other Automation Activities

Although the MARC Project is the most advanced of the many projects identified with the central bibliographic apparatus, work is going forward in other areas, some in the planning stage and others more advanced. Several special studies have been made in conjunction with the MARC Project such as development of a character set to handle diacriticals and special characters, and an analysis of bibliographic data conversion costs.

Other projects in varying stages of development include:

A. National Serials Data Program--a working paper was prepared in 1967 (38) and the serials format working document was recently published (32).

B. Retrospective Conversion (RECON)--the feasibility study for converting retrospective records into machine-readable form has been completed and published in the report, "Conversion of Retrospective Catalog Records to Machine-Readable Form" (31).

C. Development of an experimental program for the sorting of bibliographic records.

D. Development of Software for LC's internal requirements.

E. Use of the MARC II format and the MARC System for automation of the collection of single maps in the Geography and Map Division. A pilot map format has been designed and is now in use.

F. Use of the MARC II format and the MARC system for the Legislative Reference Services.

G. Conversion into the MARC II format of the Government Printing Office's machine-readable tapes that were used to print the 7th edition of LC's list of subject headings (13).

H. Continued cooperation with COSATI, the United States of America Standards Institute (USASI), and the United States National Libraries Task Force on Automation and Other Cooperative Services.

I. Design and implementation of a generalized statistical program for data contained in the MARC II format.

VI. Observations

The need for some unifying force to bring libraries closer together has been apparent to many people ever since automation became an important consideration for library operations. The Library of Congress has assumed this responsibility, and rightfully so, for it is the only library system in this country capable of serving the entire library community.

Although the automation program of the Library of Congress is far from complete, the results to date are worthy of attention. As would be expected in an undertaking of this size and importance, it has had some vocal critics. But more importantly, it has had very interested observers and has generated among many librarians an enthusiasm and a genuine desire to understand the program and to relate it to their own library systems. As a result of the Library's accomplishments, a great step forward has been taken toward the exchange of machine-readable cataloging data and the development of networks.

Librarians quite naturally are interested in the work which will touch them directly--the MARC II format, which provides a means of standardizing bibliographic data, and the Distribution Service, which provides cataloging data in machine-readable form and a communication medium among libraries. The MARC Institutes, which have been held throughout the country, and the many reports and manuals which have been issued keep the librarians informed about the progress of these various aspects.

Librarians at all levels and in all categories should read the details of the development of the program and attempt to relate it to their own internal operations. The magnitude of LC's program will not, of course, be matched by any other library; but the overall approach has used many techniques that are relevant to libraries of lesser size and in more restricted environments.

They would do well to consider the constraints that have been present within LC's program. It may come as somewhat of a surprise to realize that LC has had the usual problems of time, money, equipment, and personnel which affect most libraries and that they have had to compromise, adjust, and modify just as other libraries have to do. It is probably true that LC has found it easier to get outside financial support since the granting agencies realize the impact of LC's efforts. But considering what has had to be accomplished with this support, the money available has been no more generous than for some other libraries. The equipment has not been exceptional, and most of the personnel have had to be trained on the job.

The detailed planning which has gone into the program should be of interest to all librarians. The time spent in studying the present system and evaluating its many parts emphasizes once more the importance of knowing what and how things are being done before attempting to design a new system. The fact that the total systems approach is being used in planning but that the implementation is undertaken in reasonable segments offers a practical lesson in handling complex problems. Certain aspects of LC's operations obviously would not be encountered by other libraries, but the techniques used to make various studies and the steps taken to reach certain objectives can be studied with profit by others in relation to their own libraries.

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LOS ANGELES COUNTY PUBLIC LIBRARY
LOS ANGELES, CALIFORNIA

SUMMARY

As the largest county library system in this country, the Los Angeles County Public Library consists of over one hundred outlets and covers a wide geographic area.

Book catalogs have been the answer to providing access to the entire Library collection and improved service for all patrons in the system.

The Library's first book catalogs, begun in 1952, were prepared on punched cards and processed on unit record equipment. After about ten years this method was replaced with sequential camera processing. Several years ago the sequential camera was replaced by computer technology. Input records are now being prepared on Selectric typewriters with font that can be optically scanned and read into the computer to be stored on magnetic tape. Retrospective records are in the process of being converted to machine-readable form and complete conversion is expected by early 1970.

I. Background

The Los Angeles County Public Library is the largest county library system in the United States and the third largest public library system, with a book collection exceeding three million volumes. Besides the central headquarters in downtown Los Angeles, there are nine regional libraries serving more than one hundred outlets consisting of city and small community branches, branches in county institutions, and mobile libraries. The system has about 900,000 registered borrowers and the annual circulation exceeds eleven million volumes.

The Library began operations in 1913 as a rural service to 100,000 people living in small scattered communities throughout an area of more than 3,300 square miles. Patrons were served by many small branches whose book collections were periodically "revolved" or exchanged. The Library's policy was to purchase a large number and wide variety of titles but a small quantity of each title. A request service enabled patrons to obtain titles not available in the local branch.

The rapid growth in population after World War II transformed rural areas into urban communities and presented the Library with a multitude of problems and needs. The Library had to strengthen the book collection, to provide buildings, to recruit and train professional staff, and to develop bibliographic tools and techniques for dynamic and effective service.

From the beginning a dictionary card catalog and book-location records had been maintained at central headquarters. Only a few branches had card catalogs, and each of these listed only the holdings in the branch where the catalog was located. In 1952 only 25 of the 114 outlets had card catalogs for the individual branch holdings; and the Central Library, miles away from most branches, had the only union card catalog. And so, although the book collection was excellent both in depth and breadth of quality, there was no effective or practical media for informing the patrons what titles were in the entire County collection or where they were located.

In an effort to heed the pleas of branch staffs for catalogs, many ideas were considered and discarded. An estimate of $400,000 to install a card catalog of only the local holdings in every branch was sufficient reason to discard this idea.

Fortunately for the Library, its many branches, and its patrons, the time was right to consider producing book catalogs. From this decision one of the most successful and widely accepted book catalog projects came into being. Geller (1), Henderson (2), Hewitson (3), and MacQuarrie (6) have described these early developments in some detail.

II. Development of Book Catalogs

A. Using Unit Record Equipment

After an extensive feasibility study, the Library decided in 1952 to produce book catalogs which would eventually contain the complete holdings of the Los Angeles County Public Library System. The success of the King County (Washington) Library System in using punched cards and unit record equipment to produce its union lists provided much of the motivation for using the modern technology. A further inducement was the availability to the Library of the County Government's data processing equipment.

The decision was made in the beginning to have divided catalogs for adults and children. The adult catalog was divided into five sections--author, title, subject-nonfiction, subject-fiction, and foreign language. The children's catalog was divided into author, title, and subject.

The first catalogs were completed during 1952-54, and for the first time both the patrons and the staff of each branch had convenient access to the total collection. Specific holdings for Central and each region were identified in the catalogs. After the initial printing, the catalogs were updated by monthly cumulative supplements and incorporated into the bound volumes every 18-19 months.

For the next ten years the Library produced its book catalogs by using punched cards and unit record equipment. During that time the catalogs in book form became firmly established as an important bibliographic tool acceptable to both library personnel and patrons.

From its inception, the future of the book catalog in this environment was never questioned; it provided service never before possible, and the advantages far outnumbered any disadvantages. There were, however, questions about the production methods related to the limitations of the equipment and the maintenance of an acceptable production schedule.

All unit record equipment has certain shortcomings, but the most obvious to the users of the catalogs were the limited character set and the unattractive and monotonous appearance. The IBM 407 Accounting Machine, which produced the printout, is limited to upper-case letters in one type size and very few punctuation marks. The text was rather difficult to read, and the bound volume awkward to handle.

Scheduling problems were also becoming more serious and interfering with production. From the beginning the Library had used the County's equipment at offpeak hours, which gave the Library low priority. As the years went by, the needs of both the County and the Library for use of the equipment were growing greater. The Library had even lower priority, and it was no longer possible to maintain a reliable production schedule. By early 1962 when it was apparent that changes would have to be made, new production methods were investigated.

B. Using Sequential Camera Techniques

After deciding to discontinue the use of punched cards and unit record equipment, the Library considered other methods of production and selected a sequential camera processing method (5).

To prepare copy for processing by sequential camera, each line of data is typed on a tab card, using a Varitype--a typewriter mechanism capable of using a variety of type sizes and styles. The tab cards are also punched with an ID number for machine sorting. The Varityped data are then photographed a line at a time by the high-speed camera onto a continuous roll of negative film. The film is developed, cut into column lengths, and arranged in page form to be printed by litho-offset and bound.

The resulting product of a sequential camera is much superior in format and readability to a printout from tab equipment; upper/lower case letters, all punctuation marks, a variety of type styles and sizes, and flexibility of size, spacing, and format arrangement provide aesthetically satisfactory copy.

Although the Library and the patrons were pleased with the results, problems were encountered almost from the beginning.

An outside contractor was engaged to produce the catalogs. Catalog data were prepared by the Library staff and sent to the contractor for processing. Errors, of which there were many, were difficult to discover and to correct. An unclear delineation of responsibilities for contractor and Library resulted in dissatisfaction on both sides. Eventually the contractor had such serious internal problems he was not able to fulfill his commitments, and the Library's production schedule could not be met.

Aside from the failure of the contractor to meet his obligations, the use of sequential camera techniques has the disadvantage of not producing machine-readable copy. By the mid-60's computer technology was becoming increasingly attractive to libraries, and the Library decided to explore this medium more fully.

III. Using Computer Technology

Because of the magnitude of converting the catalogs to machine-readable form, the transition from the use of a sequential camera to computer technology spanned several years and included some in-depth investigation into advanced production techniques.

A. Library Improvement Task Force

In 1966 the Council on Library Resources, Inc. awarded a grant to the Library to study computerized library applications in such areas as catalog production, registration and circulation control, and acquisition control.

The basic system design for book catalog production was performed by Library personnel. A special task force was created within the Library and assisted a firm of data processing consultants in additional system design and development. Many commercial organizations within the area also provided technical and informational services.

During this time a prototype system was developed, utilizing Optical Character Recognition (OCR) equipment as an input medium for computerized library systems. Demonstration projects were developed for catalog production--both card and book, for registration control, and for circulation control. An acquisition system was conceptually designed but was not used as part of the demonstration.

Five different basic types of equipment are available for preparation of input data--keypunches, paper-tape punches, magnetic tape writers, on-line terminals, and optical character recognition equipment. Each of these was discussed, and the data collection costs for each type of equipment were analyzed. The over-all conversion costs were compared, and OCR equipment was found to be the most economical as well as having a number of other advantages.

The details of this research and demonstration project appear in Zuckerman's report (7) and in the report entitled An Optical Character Recognition Research and Demonstration Project (4).

B. Computerized Book Catalogs

Based on the work of the task group and the findings of the research and demonstration project, the Library selected OCR equipment as its input medium.

Input data are prepared by the Library staff on IBM Selectric typewriters with special fonts that can be read by OCR equipment. Errors in typing can be easily corrected, and the copy can be proofread just like any other typewritten copy.

For a number of reasons the Library has chosen to have all processing and programming done by an outside service bureau. After the copy is typed in the Library, it is sent to the service bureau where it is optically scanned for transfer to magnetic tape and production of a printout. Before storing the data in the computer, a printout is returned to the Library for proofreading; with these procedures machine errors are expected to be reduced to one in a million.

After the data are read onto magnetic tape for computer processing, tapes are merged, supplements are produced, and periodically the supplements are merged into the MASTER tape file.

The present schedule calls for bimonthly supplements to cumulate for seven supplements, after which the cumulations will be added to the MASTERS and complete catalogs containing both retrospective and current entries will be produced.

The Children's MASTER Catalogs have been completed, and the Adult MASTER Catalogs are scheduled for completion early in 1970. The catalogs are divided as they have been in the past and are attractively printed in upper and lower case and with sufficient punctuation marks. Patrons and staff members appreciate the appearance and readability of the catalogs and their value as an up-to-date bibliographic tool.

At the present time the Library has no dictionary card catalogs. Central maintains an author/title authority file which also serves as a location file for the entire system. Each region maintains a location file for its region, and each outlet or branch has its own shelf list.

IV. Facilities for Automation--Hardware, Software, Personnel

Since the beginning of book catalog production, the Library has had various kinds of equipment for preparing the input. First there were keypunches and now IBM Selectric typewriters with OCR font.

The equipment for processing and production, however, has not been in the Library. The unit record equipment was in the County offices. The sequential camera processing and production were done by a contractor.

Los Angeles County policy does not allow computers in individual offices and institutions even though studies have shown such an approach to be more practical. Users, therefore, have to use the County's central processing center or go elsewhere for services. Since the County machinery was out of date, over-burdened, and entirely inadequate for library needs, the Library looked to the outside for assistance. As a public agency, it must seek bids; and the service bureau now used was first determined to be among those technically capable and then was selected solely on the basis of cost.

V. Addenda

A. The Library's approach to integrated data processing is through the bibliographic apparatus. Contrary to those who favor entering the data in machine-readable form at the earliest possible time (acquisitions) and updating the records as the new data are available, this Library takes the view that much of the acquisition data are not of value for catalog preparation and much of the cataloging detail is not useful for acquisitions. This attitude was suggested in Zuckerman's article (8).

B. Although book catalogs are well established and are answering many of the needs in this Library system, the staff is of the opinion that the value of book catalogs in general has not been studied sufficiently. Book catalogs are something of a fad at this time, based on the assumption that they provide the best means for access to the collection and that they are easy to produce when the data are in machine-readable form. This assumption oversimplifies or ignores the many important questions related to catalog usage and bibliographic control. Staff members are asking such questions as whether one catalog is sufficient for all uses or whether some libraries need one for the research audience and one for general use.

C. Once the conversion of the catalog records to machine-readable form is completed, further studies will be made in circulation control, registration control, and probably acquisitions control.

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Personal Communication with Mr. Goodwell, 1969.

LOS ANGELES PUBLIC LIBRARY
LOS ANGELES, CALIFORNIA

SUMMARY

The Los Angeles Public Library, one of the largest city public libraries, is serving the fastest growing area in the country. It has extensive plans for a fully integrated electronic data processing system.

The MASTER PLAN contains five basic elements: (1) Patron Registration, (2) Book Ordering, (3) Serials, (4) Central Shelf List and Branch Union List, and (5) Criculation. Serials and Circulation have not yet begun. Book Ordering is functioning smoothly, and the Central Shelf List and Branch Union List are under way. Patron Registration has caused the greatest problems, primarily due to a malfunctioning computer at a very crucial time in the change-over.

The Library, as a City agency, is required to use the City's computer facilities and, except for the Police Department, is now the biggest computer user.

I. Background

The Los Angeles Public Library, one of the largest city public libraries in the country, has over three million volumes and over six thousand periodical titles. Its organization includes the Central Library, seven regional libraries, bookmobiles, and over sixty branches. Since it is both the leading research library in the area and a general facility, it attempts to cover in depth all fields except a few specialized ones such as medicine and law.

The Library is recognized as one of the finest in the country and has an excellent record of service to the community. It presently has over one million registered borrowers and an annual circulation of about fourteen million volumes.

As an agency serving an area with the fastest growing population in the country, its experiences in connection with library automation are indicative of the tremendous problems facing a very large library located in a rapidly growing area and dependent on city government approval for finances. On the other hand, the Library's experiences are somewhat unique in one respect--whereas all libraries have some of the problems that Los Angeles Public has had, very few have faced so many at one time.

The Library administrators, department heads, supervisors, and others of the professional staff think that the idea of an integrated system is right and that the future of library automation is promising. But in the course of achieving their objectives enroute to a total system, they have encountered a multitude of problems which they are willing to share with other librarians.

II. Objectives

The December 1966 issue of the Wilson Library Bulletin contains an article outlining the plans for a fully integrated electronic data processing system for the Los Angeles Public Library (1). This Master Plan, when fully implemented, will be the first of its kind in a public library.

The plan as outlined contains five basic elements which are to be coordinated but which can also function independently:

A. Patron Registration

The records of all borrowers will be maintained by computers. Registration will be for life for City residents and for one year for others, instead of registration for three years for all patrons.

B. Book Ordering

LAPL purchases approximately 67,000 titles (268,000 volumes) each year at an expenditure of over one million dollars. Data processing techniques are expected to speed up orders, increase discounts, reduce errors, and accelerate delivery time.

C. Serials

The system has been designed to maintain the records for about 30,000 titles and to check their status and location.

D. Central Shelf List and Branch Union List

These will be converted for computer printout and distributed to the City Library agencies. Other libraries may purchase them.

E. Circulation

New transaction (loan) equipment will replace the photolending system in operation since 1949. The new operation is expected to reduce the loss of books, speed the mailing of overdue notices, and provide better statistics on usage.

III. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

The Library at one time had tabulating and keypunching equipment, but the tabulating equipment was later eliminated. It now has keypunches for preparing computer input as well as telecommunication equipment.

In 1963 the data processing centralization ordinance concentrated all computer services for the City into the Data Service Bureau, so that any agency requiring computer services is expected to use the Bureau. At the present time the Bureau has an IBM 360/30, two IBM 360/40, and an IBM 360/50 plus an extensive assortment of peripheral equipment.

The Library employed consultants to design and implement the system and most of the programming was done by staff members of the consultants.

B. Personnel.

Library employees received training in data processing applications. Members of the staff serve on steering committee during design and implementation.

IV. Activities, Problems and Decisions

A. Patron Registration

Early in 1966 the patron registration system began--the forms were ready, staff members were trained, special manuals were printed, and extensive publicity was given the project. By May, patron registration was transferred from card files to magnetic tape and new cards were printed on the computer and mailed to selected, active card holders. Registration of former patrons and new patrons, using the new forms, appeared to be going well until the City's newly installed equipment began to malfunction. Instead of receiving the new computer-printed library card within one week after application, patrons waited three and four weeks and more; eventually the library staff had to issue temporary cards.

A Master Patron Directory of 30 volumes is now housed in the Circulation Department of the Central Library. This Directory must be consulted by telephone by all branches when the patron's library card number or status is required. Since the telephone lines are very busy, delays are common.

A combination of human and computer errors have caused a number of breakdowns in the overdue process, so that the receipt of the first notice is not as soon after the due date as the Library would like.

Critical delays have been experienced in preparing the Delinquent Reports and printing 85 copies of this Report Weekly. Due to the size, the Report has become quarterly with weekly supplements instead of weekly cumulations, as originally planned.

No one, of course, expected that the malfunctioning of the computer would be so extensive and serious and that pre-computer and post-computer processing would be so susceptible to error and delay. As a result, what started out to be an efficient, controlled, well-planned system became a costly burden to the staff and the patrons.

B. Book Ordering

Automated book ordering began in 1967. The majority of orders are handled by a primary vendor and are sent by telecommunication. If an order can be filled, it is shipped at once; if not, a message is sent back by telecommunication.

Other orders are keypunched and sent to the Data Service Bureau for computer processing. The computer-produced purchase orders are then mailed to the vendors.

The ease of ordering and billing has enabled the Library to take better advantage of discounts for prompt payment.

C. Serials

Ordering of serials and maintenance of serials files are planned for implementation in 1969-70.

D. Central Shelf List and Branch Union List

Central Shelf List information, with the addition of two subject headings, is now being keypunched to be put on tape and printed in shelf-list order in book form. Information on holdings at all branches is also being acquired to be printed in author sequence in the Branch Union List.

When all holdings are known, over three million machine-readable book checks and labels for book pockets will be generated and placed in the books. The computer-produced book checks and labels will have call number, author, title, and price interpreted. In addition, Book Identification Numbers, which identify titles, will be assigned by the computer and interpreted. These numbers will be used in the ordering and circulation systems. (Titles on the new order system already have Book Identification Numbers.) New 3-digit copy numbers will also be assigned. Henceforth, the computer will print book pockets, book checks, and spine labels for materials as they are needed.

Both the Central Shelf List and the Branch Union List will be updated automatically from input from the ordering and overdue systems and from withdrawal processing. The card shelf lists will be retained for a time in all units. There are no plans for book catalogs to replace the card catalogs in the Library system.

E. Circulation

The Library is awaiting the perfecting of a transaction device. The cost and feasibility of an online system is also being investigated.

V. Observations by the Library Staff

A. The Municipal Government

The Library, as one of the agencies of the City of Los Angeles, is subject to certain restrictions imposed by the City Government. Those that have affected the automation program most directly are:

1. Equipment

The Library must use the Data Service Bureau, a computer center of the City of Los Angeles. At the present time, except for the Police Department, the Library is the biggest computer user.

Since the Library's data are processed in batches, the Library suffers the inconveniences of sharing a computer with many users and of having to transport the cards some distance to the computer facility.

2. Personnel

All employees are under city civil service. Some authorized positions in the Data Service Bureau have gone unfilled because qualified employees have not been available for the hours scheduled or the salary paid. This has made it difficult for both the Bureau and the agencies it serves to maintain satisfactory schedules. To a lesser degree the Library has also had staff shortages.

3. Budget Limitations

Budget limitations are always a problem and for the Library has caused some delays.

B. Consultants

Consultants have been used with only moderate success. The consensus is that, although an effort was made to understand the Library's problems, the Consultants were not always successful in recognizing the needs and in analyzing and forseeing the many problems.

The Consultants had to rewrite inefficient computer programs and revise computer manuals to comply with the Data Service Bureau's requirements.

At first the Consultants were responsible for preparing and updating Library manuals and for training the operating staff. It then became apparent that Library supervisors could maintain the manuals and train the staff more efficiently.

VI. Sources of Data

1. Bass, David W. "LAPL and the Data Service Bureau," Wilson Library Bulletin. XLI, December 1966. p. 405-408.

2. Site Visit in December 1967. Interview with Mrs. Frankie G. Runzo, Director of Technical Services.

Personal communication with Mrs. Runzo, 1969.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
PROJECT INTREX
CAMBRIDGE, MASSACHUSETTS

SUMMARY

Project INTREX is probably the largest library-related research project going on at this time. Its objective is to provide a design for evolution of a large university library into a new information transfer system that could become operational in the 1970's. The Project consists of a coordinated program of many information transfer experiments, some going on now and some to be done later.

The computer-stored augmented-catalog program includes machine-stored bibliographic records consisting of the usual catalog card content plus additional information pertaining to the document. Records are stored online for remote access by the user. Documents include books, journal articles, technical reports, reviews, theses, pamphlets, conference proceedings, etc.

The Text-Access Program stores the full text of documents on microfiche and are retrieved, scanned, and transmitted for display upon user request.

I. Background

Project INTREX (Information Transfer Experiments) at the Massachusetts Institute of Technology is probably the largest library-related research project now being conducted in this country. Its objective is to provide a design for evolution of a large university library into a new information transfer system that could become operational in the 1970's.

The Project began in 1965 with a five-week planning and study conference attended by participants and visitors representing all segments of librarianship as well as Government agencies, publishing, engineering, and other areas of business and industry.

The purpose of the Conference was to formulate a coordinated program of information transfer experiments to be performed as Project INTREX by MIT.

During the Conference three main streams of progress in information transfer were identified and discussed:

(a) The modernization of current library procedures through the application of technical advances in data processing, textual storage, and reproduction.

(b) The growth, largely under Federal sponsorship, of a national network of libraries and other information centers.

(c) The extension of the rapidly developing technology of online, interactive computer communities into the library and other information centers.

The conclusion was that the university information transfer system of the next decade will result from a confluence of these three streams.

MIT, dedicated to research and experimentation, is well qualified to handle experimental projects of this magnitude. It was one of the pioneers in the development of computers, it has a very large library system, and its library users are accustomed to the experimental approach and willingly cooperate in meaningful tests of new services.

It was decided that the program of Project INTREX should be directed mainly to the broad problem of access--access to bibliographic material, documents, and data banks. A number of recommendations and suggestions were made regarding the conduct of the program--some to begin soon and some at a later date. One of the first tasks recommended was the establishment of a "Model" Library to provide an environment in which to perform the experiments.

Results and full details of the Conference are published in INTREX. Report of a Planning Conference on Information Transfer Experiments (2).

II. Activities

Since this Project consists of a coordinated program of information transfer experiments, there are many activities going on simultaneously, and they are in varying stages of development. They not only include experiments in connection with handling documents and processing the information but also with hardware, software, users, user aids, procedures, and other aspects that require testing. Furthermore, since MIT has a vast program of research, Project INTREX is able to utilize the results of research carried on elsewhere in the Institution. All experiments and activities are interrelated so that data obtained in one experiment are used in others.

An experimental machine-library facility has been established to maximize the variety of options available to both users and those designing experiments.

Two experiments that have been going on for some time are the computer-stored augmented-catalog program and the text-access program. Following is a very brief description of each:

A. Computer-Stored Augmented-Catalog Program

The bibliographic records for selected literature from materials science and engineering is put into machine-readable form. This machine-readable catalog covers books, journal articles, reviews, technical reports, theses, pamphlets, conference proceedings, and any other form of recorded information pertinent to the subject. Contents of each bibliographic record include not only the contents as usually displayed on a catalog card, but also additional information such as deep index terms, affiliation of the author(s) of the document, and bibliographic data of cited documents. These records are stored online for access from a typewriter terminal or console by the library user.

B. The Text-Access Program

This is a program to provide access to the full text of the documents in the INTREX data base (see above). The documents are photographed and stored on microfiche and are retrieved, scanned, and transmitted for display upon user request. The user may request either soft copy displayed on an electronic storage tube or a 35-mm film facsimile; hard copy may be obtained from the film strips.

Project INTREX is also interested in the interaction of a computer-based university information transfer system with other information resources and the integration of such a system into a national, and even international, network of information centers. Experiments will also be made on rapid fact retrieval, teaching and learning in the online network, browsing, selective dissemination of information, use of the online network for manuscript preparation, and publishing. Considerable time has been spent on improving or redesigning the hardware, such as the display-console system, and the software.

This is a very brief account of a complex group of experiments. However, reports on this long-range project are issued regularly every six months, and the technical aspects and operating details are well documented (1).

III. Sources of Data

1. *Massachusetts Institute of Technology. Project INTREX. Semiannual Activity Report*. Cambridge, Massachusetts.

   PR-1 15 March, 1966
   -2 15 September, 1966
   -3 15 March, 1967
   -4 15 September, 1967
   -5 15 March, 1968
   -6 15 September, 1968
   -7 15 March, 1969
   -8 15 September, 1969

2. Overhage, Carl F. J., and Harman, R. Joyce, eds. *INTREX. Report of a Planning Conference on Information Transfer Experiments*. Cambridge, Massachusetts: The M.I.T. Press. 1965. 276p.

3. Site visit, November 1967. Interview with Mr. Charles H. Stevens, Librarian, Project Office Staff.

MICHIGAN STATE UNIVERSITY
LIBRARY
EAST LANSING, MICHIGAN

SUMMARY

The Library of Michigan State University has more than tripled its holdings within the last fifteen years. As a result of a number of studies pertaining to automation, circulation was identified as the area most in need of immediate attention.

In order to create the necessary book card for the circulation system, it was decided to convert a portion of the bibliographic record from each card of the shelf list. These shelf list records are stored on magnetic tape, and book cards for the existing collection were generated as a product of the tape.

The circulation system uses Friden Collectadata-30 equipment and stores the transactions on punched paper tape which is processed daily to update the circulation records.

In connection with the automation studies, a comparative cost study was made of keypunching, paper-tape typewriting, and optical scanning as the methods of input to the computer. The excellent service given by an outside service bureau using the optical scanning equipment has convinced the Library that the use of outside service bureaus should be given serious consideration for large-scale conversion of records to machine-readable form.

I. Background

Michigan State University is a rapidly growing institution of over 40,000 students, with a wide assortment of graduate and undergraduate programs. The Library has grown from about 400,000 volumes in 1955 to more than 1.5 million at the present time.

The Main Library with its large new addition houses most of the collection. The remainder is located in Engineering, Business Administration, Living-Learning Centers, and numerous departmental libraries, the latter having mostly reference materials.

All processing is done in the Main Library. A Shelf List but no official catalog is maintained, and the public catalog is divided into author/title and subject.

II. Philosophy

The Library's approach to automation has been delineated in Chapin's article appearing in the 1967 Clinic Proceedings of the University of Illinois (1). He discusses the decisions that have to be made when considering automation and identifies six criteria to be considered before accepting any system:

1. Cost
2. Capacity to handle an increased load
3. Better utilization of resources
4. More complete and/or additional reports
5. Acceptance of a system by the user and the staff
6. Accuracy and currency

In making new procedures successful perhaps the biggest factor to be considered is psychological. The importance of user and staff acceptance and of the cooperation from the administration are elements which cannot be underestimated.

III. Facilities for Automation--Hardware, Software, Personnel

There are two large computer facilities on the Campus--Business and Research. The Library selected the Business computer since its staff has given the Library very high priority and assurance of daily processing time between 11 p.m. and 8 a.m.

An IBM 360/30 is usually used for Library processing, and an IBM 360/40 occasionally. Most of the programs are written by the computer staff. The Library has one keypunch, two Flexowriters, and Friden Collectadata-30 units.

IV. Activities

Studies within the Library led to the conclusion that certain routines within acquisitions, serials, card production, and circulation could be automated. The decision was then made to automate circulation first.

In order to automate circulation procedures, it is necessary to have some sort of machine-readable record of all books that are to circulate. Since the majority of present automated circulation systems require a book card, the decision had to be made as to what to include in the machine-readable record. The choice ranged from the accession or call number only to inclusion of the entire bibliographic content such as appears on a catalog card or in a MARC record.

Obviously the Library needed more than a call number if the machine-readable record was to be used for more than production of a book card. On the other hand, it did not seem necessary at that time to include complete bibliographic data. It did, however, seem important to design a total program so that additional bibliographic data could be added at some later time.

It was then decided to convert a portion of the bibliographic record from each card in the entire shelf list in order to produce a master book tape (on magnetic tape). From the master book tape a book card would be produced for each book in the collection.

Based on these decisions, the following projects have been undertaken:

A. Conversion of Shelf List Records to Machine-Readable Form

Raw data must be converted to machine-readable form so that it can be read into the computer. The most common methods of preparation are punching cards on a keypunch, preparing punched paper tape on a paper-tape typewriter, or using an optical scanner. There are also other methods, but these three are the most available to libraries. Each method, of course, has advantages and disadvantages.

Before deciding which method of input to use, the Library received a grant from the Council on Library Resources, Inc. to conduct a cost study comparing the three methods--keypunching, paper-tape typewriting, and optical scanning.

The shelf list records were divided into three sections by a random process, each third to be done by one of the methods. All bibliographic data were taken direct from the shelf list cards rather than transferring to intermediate worksheets. Most shelf list cards are copies of LC cards or proof slips.

Operators were instructed to extract from each shelf list card the entire call number (32 spaces), copy number (3 spaces), a maximum of 39 characters for the author, a maximum of 43 characters for the title, and 4 for the date of publication.

All keypunching and paper-tape typewriting were done in the Library by four operators with varying degrees of experience. The optical scanning method was handled by a service bureau in Dayton, Ohio. Operators in the service bureau used IBM selectric typewriters with special type font. The resulting records typed on continuous form paper were sent through the optical scanner and read onto magnetic tape.

The keypunching cost and the service bureau cost were identical--6.63 cents per record. Paper-tape typewriting was slightly higher--7.07 cents.

Based on the results of this study, the Library has concluded that converting a portion of the bibliographic record is relatively inexpensive compared to the total cost of library automation. Conversion is a one-time cost, and the differences in cost of the three methods used are not significant. The staff is in favor of using an outside organization to convert the records. The use of a service bureau eliminates the need to hire and train many short-term machine operators and to obtain the necessary equipment for a limited time. The fact that portions of the shelf list were out of the Library for as long as two weeks did not cause any great inconvenience or pose any special problems.

The Library staff is very pleased that more than the call number was converted to machine-readable form. Uses have already been found for the author and title entries on the master book tape. They can be used to produce an effective classified catalog and are a help in replacing certain catalog cards. One drawer of the author-title catalog was "misplaced," and the master book tape has already been used to print out the necessary author and title entries that were lost.

This minimum format of converted records will be useful in making library use of studies. Circulation statistics will aid in book selection. If and when it is thought necessary to add more bibliographic information to each record, the programs are available to update the master book tape.

The methods used and the results of the study are reported in more detail in the Library's report to the Council on Library Resources, Inc. (2) and in the Chapin-Pretzer article in the Journal of Library Automation (3).

B. Circulation

The use of data collection equipment for an automated circulation system has become fairly common. Most systems use a borrower's ID badge and a punched book card which are put through the data collection station to produce either one or two transaction cards. The MSU system is sufficiently different to be of interest.

As mentioned above, book cards for the existing collection were created from the master book tape. Each card provides space for the entire call number (32), 3 for the copy number, 11 for author, 26 for title, and 4 for the year published. Flexowriters located in the Library are used to update the master book tape on a weekly basis, and book cards are produced from these weekly tapes.

Friden Collectadata-30 units were selected as the equipment to handle the circulation. A 3002 transmitter accepts the ID badge and the book card. Dials on the face of the unit permit a "dial-in" of the type of transaction. This information is received and punched on a paper tape in the 3031 receiver located in the basement of the Library. A clock in the 3042 central control unit records the time (to 100th of an hour) and data of the transaction--either charge or discharge.

On a normal day about two rolls of tape are used. Each night after closing the paper-tape rolls are taken to the Computer Laboratory and processed on the IBM 360/30 before 8 a.m. the next morning. The magnetic tapes for circulation are updated, and the Library receives an up-to-date circulation list each morning.

There are several features of the system that the Library particularly likes. With the clock attachment, it is possible to keep very accurate account of who has what. In a University of this type the same book may circulate several times in one day; by knowing exactly when the book was charged and discharged there is little chance of mixup.

The same equipment is being used to handle the time cards for about 500 student assistants. Each has a card which he uses to punch "In" and "Out" at the Circulation Desk. The resulting records on paper tape are used to prepare the payrolls.

There are now four units at the main desk, but as many as 20 units can be connected within a radius of two miles. Also the equipment can be computer connected when the Computer Laboratory has online capabilities. Furthermore, the Collectadata system costs about $100 a month less than comparable competing systems.

The present circulation system has proved to be very workable. It has eliminated bottlenecks, end of semester pressures, and many of the inefficiencies which existed before. It has improved record keeping and inventory control, speeded up book shelving, and has made it much easier to claim overdue books and send claim notices. The system has also pleased the borrowers since they no longer have to fill out charge slips and stand in long lines for service.

C. Serials Holdings List

A serials holdings list was completed in June 1969, and is now available. Initial input was prepared by the service bureau, using the same optical scanning method as was used in converting the shelf list. However, due to the complexity of the records, the Library found that it had to correct many of the records converted by the service bureau.

V. Addenda

The Library is convinced that the use of an outside service bureau should be given serious consideration for a large-scale conversion of records to machine-readable form. Even considering the large number of corrections required after the conversion of the serials records, the Library feels that the contribution of the service bureau was invaluable when considering the massiveness of the project. With a more easily identifiable record (such as the shelf list), the service bureau's conversion was quite satisfactory. A bureau's expertise in machine operations and its level of accuracy far outweigh the few disadvantages of sending the records out of the library.

The outputs from the master book tape and the circulation system have been invaluable in getting necessary information for better library operations.

The staff is very cost conscious, keeping complete records of all expenditures including computer charges. It is not convinced that book catalogs would be worth the expense involved. The Library expects to go online in the future and to expand automation projects to other areas.

VI. Sources of Data

1. Chapin, Richard E. "Administrative and Economic Considerations for Library Automation." In: *Proceedings of the 1967 Clinic on Library Applications of Data Processing.* Dewey E. Carroll, ed. Urbana: University of Illinois Graduate School of Library Science. 1967. p. 55-69.

2. Chapin, Richard E., and Pretzer, Dale H. *Comparative Cost of Converting Shelf List Records to Machine Readable Form.* (Report to Council on Library Resources, Inc. on CLR-337) East Lansing, Michigan: Michigan State University. December 1967. 14p.

3. Chapin, Richard E., and Pretzer, Dale H. "Comparative Costs of Converting Shelf List Records to Machine Readable Form," *Journal of Library Automation.* I, March 1968. p. 66-74.

4. Site Visit in March 1968. Interviews with Dr. Richard E. Chapin, Director of Libraries, and Mr. Dale H. Pretzer, Assistant to the Director of Libraries.

Personal Communication with Dr. Chapin, 1969.

REDSTONE SCIENTIFIC INFORMATION CENTER
REDSTONE ARSENAL, ALABAMA

SUMMARY

The Redstone Scientific Information Center (RSIC), serving all of the activities located within Redstone Arsenal, is a large special library-information center. It has designed and partially implemented one of the most elaborate automation systems existing in any library--the Automated Literature Processing, Handling and Analysis System, known as the ALPHA System.

Work began in 1962 on ALPHA-1, an offline, data-base system relating to books, documents, and serials. The System is composed of five separate but interrelated subsystems, each with its own Master File. These subsystems are Patron File, Serials File, Book File, Document File, and Language (authority) File. By 1968 Patron registration and control; acquisitions, circulation, and portions of cataloging of books; and the Serials subsystem had become operational.

The RSIC was one of the original sixteen participants in the MARC Pilot Project. Eventual integration of the MARC data into the local automated book cataloging process is anticipated.

During 1968 work began to convert from ALPHA-1 to ALPHA-2, an online, real-time processing system, using remote devices to access the computer. The modules or subsystems of ALPHA-2 are basically the same as for ALPHA-1 and the conversion will proceed in phases.

In the future research effort will be concerned with the storage, retrieval, and transmission to users of actual documents under computer control. Special attention is being given to designing a a system which is general and felxible enough to handle possible changes in mission requirements within RSIC and also to be useful to other libraries. As networks develop, the Center is expecting to become an active participant.

This summary gives the status of the ALPHA system as of November 1967.

I. Background

Redstone Arsenal is a huge complex of about 40,000 acres located close to Huntsville, Alabama. It is the nerve center of the U. S. Army's missile and rocket programs and also includes the George C. Marshall Space Flight Center of NASA and several contractors' facilities. Total employment within the Arsenal complex is something over 40,000 persons.

Library and information services for this vast complex are provided by REDSTONE SCIENTIFIC INFORMATION CENTER (RSIC) which is under the Directorate of Research and Development, U. S. Army Missile Command, but is supported jointly by the U. S. Army Missile Command and the George C. Marshall Space Flight Center. It also serves the information needs of all other Army activities and local Army and NASA contractors.

The Information Center underwent some major changes in organization in 1962 and now includes four divisions: (1) Library Branch to provide complete library services to its patrons; (2) Research Branch to plan, coordinate, and direct scientific and technical literature research surveys and state-of-the-art searches; (3) Translation Branch to maintain liaison service in the most important foreign languages and provide technical and non-technical translation services; and (4) Information Programs Branch to develop better information methods by conducting investigations, feasibility studies, and tests related to the use of modern information manipulation techniques. All branches are housed in the same building to lend maximum support to the Library. This report is concerned primarily with the work of the Information Programs Branch in connection with various library functions for the Library Branch.

The potential patron group of RSIC of over 40,000 employees includes about 8,000 scientific and engineering professionals--perhaps the largest concentration of professional scientists and engineers in the country. Since Redstone is near no large universities or major technical centers, it must have a large, well-serviced library. Its collection consists of over 125,000 books; almost a million documents, most of them "classified;" and over 2,500 serial titles (10,000+ subscriptions). The Center is also the Southeastern U. S. agent for the Defense Documentation Center and thus receives and grants access to all documents in DDC's central collection.

RSIC is a leader among Army libraries and has participated actively in all efforts to coordinate and strengthen the resources and services of the Army libraries, such as the Army Technical Library Improvement Studies (ATLIS). ATLIS is an exploratory development project which has as its objective the improvement of service from technical libraries. There are four principal areas of effort: (1) Management and Technical Direction to analyze library organization and procedures and the resource requirements to provide the necessary information; (2) Library Operations to conduct feasibility studies in central cataloging operations and in initial distribution procedures as well as to conduct all studies for the automation of library operations; (3) Library Services to investigate the training needs for both the library users and the technical librarians and information specialists who staff and operate the library; (4) Advanced Technology to conduct research on procedures for the operation of internal SDI (Selective Dissemination of Information) Systems.

As perhaps the largest of the Army libraries, RSIC has a dual obligation to provide extensive and timely service to its own patrons by using the best techniques and equipment available to it, and also to make available to other libraries, especially those of the Army, research and development results in library automation.

As part of its contribution to the ATLIS program, the Information Programs Branch has developed and the Library Branch is using the Automated Literature Processing, Handling and Analysis System, known more familiarly as ALPHA. This report summarizes some of the work going on in connection with ALPHA.

II. Concepts of ALPHA

The Automated Literature Processing, Handling and Analysis (ALPHA) System is a technique for the integrated performance of all functions of a library that are presently amenable to automation. It is based on the concept that all non-intellectual library operations are part of an organic whole, that is, that all operations use the same facts.

Analysis revealed that the non-reference activities were by no means insignificant, and this led to the conclusion that no effective solution of information retrieval problems was possible without unified automation of these various functions.

Further analysis revealed that the kinds of non-reference activities and the administrative information required in the operation of a library can be classified into two broad categories: (1) Patron Information, giving everything about each patron including profiles of interest, routing requirements, and security data; and (2) Bibliographic Information, giving all qualifying information relating to books, serials, and documents.

The ALPHA System, to be considered a single, integrated system, is to progress through several generations.
Each generation of the system will consist of a group of

subsystems, each one related to the others but also capable of standing alone. Work will progress in Phases, both within each generation and also while converting from one generation to another.

III. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

The Computation Laboratory within this vast military complex has always had a large computer installation. For some time it has had IBM 1401 and IBM 7010 equipment, both batch processing systems. More recently it has acquired a number of UNIVAC 1108's multiplexed and with real-time, online capabilities, plus a wide assortment of peripheral devices. Since the Information Center (RSIC) has access to this equipment, it probably has the most powerful equipment at its disposal of any library or information center in the country.

Within the Information Center, unit record equipment, paper-tape typewriters, and IBM 632 Electronic Typewriter Calculators are used. RSIC started capturing bibliographic information on punched paper tape, using Flexowriters, in 1965. Plans call for online remote stations within the Center, using IBM 1050's with keyboard, card, and paper tape input/output. Eventually it is planned that CRT's will also be used for remote access.

Most of the programs for ALPHA-1 were written by the programming staff of the Computation Laboratory. Programs for ALPHA-2 are being written in COBOL by the staff of the Laboratory and one of its contractors.

B. Personnel

The Information Programs Branch, responsible for the development and design of the system for library automation, consists of librarians, systems analysts, and technicians. This group is responsible for design leadership and provides design guidance to the programming team from the Computation Laboratory and the outside contractors.

IV. Activities

A. ALPHA-1 System (2)

This system, begun in 1962, can be described as an offline, data-base system relating to books, documents and serials and using primarily batched-serial-processing techniques. The transactions for any one application or module are accumulated into batches for a period of time and transported to the central computer center for processing. At the computer center the transactions are sorted into the same sequence in which the master file is organized, and each record in the file is scanned by the computer to determine if any of the incoming transactions apply.

The data bases used in the system contain three types of information: Control or authority data as in the Language File and Patron Register; basic but variable information files as in the bibliographic and inventory files; and reference and statistical tables as in the inverted subject file.

1. Principles

Seven principles were considered in developing the system:

a. Machine readability shall be obtained at the earliest possible time--usually at ordering or receiving.

b. Redundant transcription shall be minimized by using prepunched transaction cards.

c. Generalizability is required to provide for possible changes in mission requirements--the system must change to satisfy RSIC needs.

d. Open-endedness and provisions for modification are essential to take advantage of the automation of other groups such as NASA, AEC, DDC, etc.

e. Many types of transactions are required to maintain the master and subsidiary files. The simplest external technique is the hopper method in which all transactions are thrown together and the machines make all processing decisions.

f. RSIC will use the work of others wherever possible for speed and economy.

g. Each automated process must result in at least as satisfactory a tool as was available through manual methods in addition to a machine interrogatable file.

2. Subsystems

The ALPHA-1 System is composed of five separate but interrelated subsystems, each with its own Master File:

a. PATRON FILE--arranged by Social Security Number and containing all pertinent data about each patron including security clearance, need-to-know, and routing requirements.

b. SERIALS FILE--arranged by Control Number which is related to the alphabetical order of titles and containing descriptive data about each title, order information, holdings, binding data, etc.

c. BOOKS FILE--arranged by Call Number and containing descriptive and inventory data plus subject tracings.

d. DOCUMENTS FILE--arranged by number and similar to the BOOKS FILE.

e. LANGUAGE FILE--arranged in alphabetic sequence by subject term; this is the control or authority file for all subject terms, cross references, and other associated data.

Within the Books and Documents Files are two subsidiary files:

- "In-process" for items not yet completely processed
- "Inventory" for items completely processed.

Information pertaining to a specific title is recorded once and at the earliest possible time. As soon as processing is completed, the record is removed from the "in-process" subsidiary file and transferred to "inventory."

Although serials, books, and documents have many of the same characteristics for processing, their differences were deemed sufficient to separate them. For example, many documents are classified and require separate handling; serials are continuous and require constant maintenance of records.

3. Operational Activities

The following activities became operational in ALPHA-1:

a. Patron registration and control

b. Subject heading control for books

c. Subject heading control for documents

d. Book ordering, receiving, and expenditure control

e. Book circulation and follow-up

f. Cataloging of books

g. Serials routing

h. Serials holdings records

i. Serials binding production control

j. Serials renewals

k. Documents inventory assistance

4. MARC Pilot Project

RSIC was one of the original 16 libraries selected to participate in the MARC Pilot Project. Although MARC had limited practical utility to the Library during the time the tapes were distributed, the awareness and the experience gained in actively participating in the Pilot Project and in the development of MARC II have been invaluable. MARC II records will undoubtedly be incorporated in the ALPHA-2 design. An account of the Center's experience as a participant in the MARC Pilot Project appears in the Final Report (1).

5. Results

Further development of ALPHA-1 was suspended in 1967 to concentrate efforts on ALPHA-2. Although all subsystems were not completed, ALPHA-1 has been considered successful, especially in terms of size of staff and variety of services performed.

In 1962, before ALPHA-1, there were 67 staff members in the Library; in 1966 there were 47, 35-40 of whom were librarians. Between 1962 and 1966 the number of patrons had doubled, periodical titles had tripled, books and bound volumes doubled, reports increased five times, and circulation tripled. This is concrete evidence of what a well-designed system has accomplished for one library.

B. ALPHA-2 System (7)

Prior to the over-all conversion from ALPHA-1 to ALPHA-2, online patron registration and book circulation subsystems were installed and demonstrated from December 1966 to October 1967. This project enabled the staff to gain valuable experience and to uncover a number of problem areas that needed further attention. Details of this demonstration are reported in the February 1968 issue of Datamation (4).

Based on the results of the previous year's demonstration, work continued in 1968 to convert from ALPHA-1, an offline system, to ALPHA-2, an online system consisting of remote inquiry stations located at various locations within the Library. As an online, real-time processing system, ALPHA-2 permits the user to contact the computer directly through remote devices.

The eventual configuration will consist of combinations of typewriter keyboards, card readers, card punches, paper-tape readers, paper-tape punches, and cathode-ray tube display devices.

Transfer from ALPHA-1 to ALPHA-2 is being made in phases:

Phase 1--Patron control; book processing--ordering, receiving, cataloging, inventory control, circulation; and language (authority file) subsystems.

Phase 2--Serials processing including holdings and routing.

Phase 3--Documents processing which will be similar to Phase 1 except for the security measures. DDC, NASA, AEC tapes will be used.

Phase 4--Information retrieval (content of documents).

All Master File records of Phase 1 will be stored on random access devices--disk or drum. These include PATRON FILE, BOOK FILE, and LANGUAGE THESAURUS, with associated indexes. By keeping the indexes up to date, the stored records are always accessible without reorganizing them every time an addition, deletion, or change is made.

One segment of the BOOK MASTER FILE is the book circulation control system which provides immediate control and maintenance of all the open literature items pertaining to location and status. Data are maintained in the file for each individual copy number, so that at any given time it is possible to query the file to learn the whereabouts or status of the book, e.g., in the library, circulating, lost, etc.

Skeletal bibliographic data are entered at ordering time and updated as the status of the order changes. Upon arrival, the cataloger keyboards additional data online via an IBM 1050. Entry into the system can be by LC number, author, title, or order/procurement data.

In the beginning it is expected that perhaps seven remote stations will be located in the Library, each with a basic function; this will simplify transfer from offline to online by making control easier.

Phases 2 and 3 will be organized in much the same manner, making necessary allowance for the differences that exist in processing the serials and the documents.

V. Future Plans

Remote stations will be located in other buildings and in downtown Huntsville. Eventually RSIC will take its place in a national network. When equipment and techniques become more economical, complete contents of actual documents will be stored, retrieved, and forwarded to users under computer control.

VI. Observations

A. Compared to other automated systems in libraries, this is one of the most elaborate in terms of design and equipment. However, the modular approach and the interrelated but somewhat independent subsystems suggest methods which would be applicable in much smaller libraries.

B. Because of the nature of its environment, RSIC must serve its patrons well by providing complete coverage in the designated subject areas and by delivering its services with speed and timeliness. Since so much of the collection consists of "classified" materials, circulation control and patron control are much more critical and important areas than in most libraries.

C. At the suggestion that the card catalog be retained for the staff and that book catalogs be produced for the patrons, the Head of the Center replied that it was his belief that the staff would accept book catalogs, but the users would not accept either book catalogs or consoles.

D. ALPHA-1 produced numerous printouts regularly and on demand. ALPHA-2, as the various subsystems become operational, should eliminate the necessity for so many necessary but bulky and unwieldy printouts which are difficult to handle. With online access, much of the data now printed in lists will be stored in the computer and called for only when required.

E. The feasibility of progressing from a simple to a complicated system (or subsystem) has been clearly described in a report by Umstead and Croxton which discusses the compatibility of five circulation systems ranging from manual to online and the requirements for converting from one to another (6).

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   Mrs. Jane F. Bentley, Chief, Operations Section, Library Branch
   Mr. Leo J. Cooney, Systems Analyst
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3

RICE UNIVERSITY
THE FONDREN LIBRARY
HOUSTON, TEXAS

SUMMARY

The Fondren Library of Rice University has had an automation program since 1964. The program began with circulation and has expanded into other areas. As one of the original participants in the MARC Pilot Project, it has conducted several studies in the use of the tapes.

Extensive efforts are being made to coordinate the vast resources of the academic libraries of the Gulf Coast area and to serve the information needs of business, commerce, and industry in that region. The Library is headquarters for the Regional Information Center Exchange (R.I.C.E.). This is the coordinating agency for a teletype information network that makes the resources of all of the libraries available to the business and industrial community in the Gulf Coast region.

I. Background

Rice University, one of the Gulf Coast's leading universities, is a private institution with extensive graduate and undergraduate programs.

The Library has also had a record of service to business and industry for over fifty years but especially since World War II when an unprecedented expansion in all the basic industries occurred within the region. During this period the Library has worked closely with other academic libraries in the area to serve the needs of the community. In the past both of these efforts have been conducted informally and without any special plan.

Within the last few years Rice and other universities in the region have recognized the need for a more formal and better organized plan for community service. Developing the Regional Information Center Exchange (R.I.C.E.--see below) has been one of the results. The libraries of the universities have made a special effort to strengthen their resources and to organize and coordinate these resources into a program that will serve the universities as well as business and industry in the area.

The Library's own research program in advanced library systems has developed concepts and techniques beneficial to other libraries in the region.

II. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

A Burroughs B5500 system with considerable peripheral equipment is in the Computer Center and used by the Library for processing circulation records.

An IBM 1401 with four tape drives, printer, and card reader/punch as well as the IBM 357 units for circulation are located in the Library. In the new addition to the Library, conduits to connect with the computer have been built into various processing areas, stock areas, and closed carrels for eventual online use.

All applications for the B5500 are written in COBOL. Autocoder is used on the IBM 1401.

B. Personnel

Several years ago the Advanced Library Systems Project was created as the "research organization" of the Library to investigate the problem of library automation on the Rice campus. A librarian is head of the Data Processing Division, the operational arm of the ALS Project.

III. Activities

The Library has had an automation program since 1964. Although it has approached the problems in a series of steps, it has utilized the techniques of statistics, mathematics, and analyses to a greater degree than most libraries.

A. Circulation

The present circulation system using IBM 357's was adopted as the result of a study which compared circulation systems and provided a mathematical approach (1).

As with 357 circulation systems in other libraries, the system requires a borrower punched badge or card and a punched book card. In this system a punched transaction card is made at the time the document is charged out and a second transaction card is made when the document is returned. The processing of these cards and maintenance of the circulation file is done at the Computer Center.

Production of the necessary machine-readable book cards and conversion to the new system were accomplished as a one-time job in about three months. A single campus-wide identification card will soon be available for use in the Library.

Although the system is presently offline, it can be converted to online without extensive modification. The concept for the circulation system is described in Ruecking's paper given at a Texas Conference (2).

B. MARC

Fondren is one of the original 16 participants in the MARC Pilot Project. During this period it has experimented with using the tapes in a variety of ways but only as pilot projects. An account of the Library's experience as a participant in the MARC Pilot Project appears in the Final Report (3).

1. One study was made on the accuracy of retrieving bibliographic data from machine-readable records when the input data supplied by requesters are incomplete, unverified, or even incorrect. A code derived from compression of title and author information was tested on a sample and yielded over 98 per cent accuracy. This study is reported in a later article by Ruecking (4).

2. The Library will continue to use MARC tapes and to cooperate with the Library of Congress on other projects.

3. Since none of the Southwest Texas institutions is large enough to utilize MARC tapes to the best advantage exclusively for its own use, a cooperative program is under consideration.

   An outside organization is microfilming the catalogs of the 18 area colleges and universities. Rice will then receive one copy of every catalog card from each institution. These will be keyboarded, matched with MARC tapes, and stored in machine-readable form. Besides having a union catalog, there are many possible uses for the data such as book catalogs, catalog and card options, S.D.I. services, special bibliographies, etc.

   The State-supported institutions of Texas utilize the tape service of Stacey's. The Fondren Library is working with Stacey's to convert to the MARC format.

C. R.I.C.E. (Regional Information and Communication Exchange)

The Fondren Library of Rice University serves as the headquarters for the Regional Information and Communication Exchange (R.I.C.E.), an information network along the Texas-Louisiana Gulf Coast. The Director is also Librarian of Rice University. The purpose of R.I.C.E. is to supply business, commerce, and industry with rapid access to the latest scientific and technical information.

Cooperating in the R.I.C.E. project are fourteen Texas academic libraries which, in combination, are making their vast resources available to Exchange Members and Users along the Gulf Coast from Louisiana to Monterrey, Mexico. Membership fees and user charges vary according to the extent of service.

All of the libraries communicate among themselves with teletype and are also connected by teletype with other libraries and information centers in the United States and Canada. The services of the Exchange include searching the technical literature, compiling bibliographies, lending books, photocopying, and selective dissemination services. It is possible for any member to have any or all of these services provided from all of the information resources of the cooperating academic libraries as well as the main scientific and technical information agencies throughout this country and Canada.

After the first year of operation, the Exchange reported 106 companies using the services during that period. Growth during the year was steady and convincing proof that business, commerce, and industry will use such services when they understand how advantageous they are.

Since formation of the Exchange, which maintains its own staff, the pressure by business and industry for services within the regular academic library has been greatly reduced. Many more resources are now available, but the Exchange provides the channel which meets the users' information needs much better.

R.I.C.E. is one of several programs in Texas provided by the State Technical Services Act, enabling colleges and universities to offer a variety of technical services to business, commerce, and industry. Accounts of these programs, including R.I.C.E., are reported regularly in Newsletter Technology for Texas published by the Bureau of Business Research, the University of Texas at Austin.

D. Other Projects

1. The Library has produced a short Winchell list (references) for the 18 libraries. This list serves as a union catalog of references; shows strengths in the reference collections which, in turn, suggest strengths in the general collections; and may eventually lead to a common acquisition program.

2. All Rice theses and dissertations, including abstracts, are being stored on magnetic tape.

3. A machine index to the works of Thomas Mann was generated for the German Department, using a modified MARC I format.

4. Names and addresses of the R.I.C.E. mailing list are stored on magnetic tape.

IV. Future Plans

A. Further cooperation with the 18 academic libraries in the area.

In the near future remote online access by the 18 libraries will be tried. Although all are now connected by teletypewriters, CRT's are faster and much more efficient. Such cooperative efforts as are taking place now suggest extension into other areas in the future, such as acquisitions.

B. Cooperation with the Library of Congress in the National Serials Project.

C. Continuing work toward network developments on the state, regional, and national levels.

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Personal Communication with Mr. O'Keeffe and Mr. Frederick H. Ruecking, Jr., Head, Data Processing Division of Advanced Library Systems Project.

SYSTEM DEVELOPMENT CORPORATION
LIBRARY SERVICE CENTER
SANTA MONICA, CALIFORNIA

SUMMARY

System Development Corporation is in the process of testing the economic and operational feasibility of a time-sharing system that allows libraries of many sizes and types to use a large computer online for technical processing and reference services. LISTS (Library Information System Time-Sharing) represents an advanced concept of service to libraries. It provides a number of options to help with library housekeeping and bookkeeping chores and can be tailored to individual library needs. Seven libraries in the Southern California area--two public, two university, two junior college, and the SDC Library--are participating in the operational test. Such a service appears to be particularly useful to small- and medium-sized libraries that are unable to develop their own systems.

I. Background

System Development Corporation (SDC) is a large research and problem-solving organization with several locations throughout the country. Originally a nonprofit off-shoot of the RAND Corporation, it now offers commercial services while continuing extensive research and developmental programs. Its projects and programs cover a wide range of activities in such diverse areas as military systems and library education.

The staff of the Library and Documentation Systems Department is concerned with research, development, and applications work in library automation, information retrieval, and related areas. The activities are of three main types: (a) state-of-the-art studies, such as editing of the Annual Review of Science and Technology for ADI/ASIS and preparation of Technology and Libraries (3) for the National Advisory Commission on Libraries; (b) tool development and evaluation; and (c) behavioral/methodological projects.

Although SDC is engaged in many activities related to the study of information, the project of interest for this report is LISTS.

II. Library Information System Time-Sharing (LISTS)

LISTS represents an advanced concept of service to libraries. Still in the testing stage, it is briefly described here because it is a form of cooperation that holds considerable promise as a practical solution to the problems of many libraries if determined economically and operationally feasible.

Since 1967, SDC has been developing LISTS, a time-sharing system that allows libraries of many sizes and types to use a large computer for technical processing and reference services. The system appears to be particularly useful to small- and medium-sized libraries that cannot afford to acquire their own computer, do not have easy access to computer facilities, and/or do not have the staff or the funds to design and develop their own systems. Here is an example of an organization (SDC) with very large technological capabilities (both hardware and software) and with a large professional staff of library and information specialists, computer specialists, and others offering a wide variety of services tailored to the individual needs of any number of libraries at a cost presumed to be less than if handled within the library.

The system is now undergoing an operational test to assess the economic feasibility of the LISTS approach to automation. Seven libraries in the Southern California area--two public, two university, two junior college, and the SDC Library--are participating in the operation.

A. Technological Foundations

SDC has had a long history in the use of computers. In 1963 it had one of the first two operating systems in the country for general-purpose time-sharing. It has spent years in developing general-purpose computer programs that allow files to be manipulated online by nonprogrammers and others not trained in computer technology.

Although many hardware configurations and programs are available within the Corporation, LISTS is built on the Time-Shared Data Management System (TS/DMS), developed elsewhere in the company. LISTS uses rapid-access mass storage for large data-base files. TS/DMS makes the data management capabilities of a large computer directly available to the user without the user having to communicate through an intermediary. In other words, the user can "talk" directly and easily with the computer by means of a terminal, such as a teletypewriter. The "conversation" is interactive with the user typing his request, and the computer typing the reply.

LISTS makes regular use of MARC tapes, which form the main data base. In addition, other machine-readable data such as those produced at NASA, DDC, Chemical Abstracts, and other agencies will be available for anyone wishing to take advantage of the contents of these files.

B. ALPS (Automated Library Processing Services) System

ALPS is the system of machine-readable files and computer programs used to support the client libraries.

1. Files

Through the system, two major files are available to libraries: (a) BIBLIO (Bibliographic Records) which contains the cumulated file of MARC records; and (b) INPROS (In process) which contains in-process records for each participating library.

The heart of ALPS is the powerful and versatile information retrieval program developed at SDC operating under time-sharing control on a large computer. Each client (library) can communicate or converse online with the system by means of a terminal as the needs arise. One or more terminals connected directly to the computer are the only pieces of equipment a library would need.

2. Services

An attractive feature of the system is the wide range of services offered and the individuality each library can exercise in selecting the services it desires.

LISTS is planned as a subscription service and enables each library to add and subtract services at will, so that no library need forfeit autonomy to gain the benefits of centralized processing. The amount of service purchased by each library can be closely tailored to its particular needs. On the other hand, the system encourages cooperation among the participating libraries, if they so desire, since up-to-date information on the holdings of each library is machine stored and available.

The system is prepared to do a little or a great deal for a library. All technical processing services are available and special bibliography services are possible with machine-readable catalog files. Services include searching the files, ordering, and claiming for acquisitions; technical processing and cataloging service such as cataloging and preparation of cards, labels, pockets, etc.; preparation of book or microfilm scroll catalogs; catalog conversion; special bibliography services; serials control; circulation processing and control; management information services; consulting services; as well as a number of miscellaneous services. More details about LISTS and the services offered are described in a brochure (5), in an article by Black (1), a report by Black and Bethe (2), and a paper by Pearson (4).

III. Observations

If the operational experiment of LISTS proves successful and economically feasible, the library service center concept could become a pattern for others. This seems to offer a flexibility and a choice which many libraries desire but which is not characteristic of most centralized processing centers. At the same time it appears to offer the potential for small- and medium-sized libraries to become involved in network development much sooner than they probably would or could if they were to develop their own systems.

Although not yet fully tested, LISTS is an advance in library automation that bears watching.

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UNIVERSITY OF CALIFORNIA
NINE CAMPUSES

The State of California has an extensive and ambitious program in higher education consisting of the University system, the State College system, and the Junior College system.

The University system, known as the University of California, now has nine campuses--Berkeley, Davis, Irvine, Los Angeles, Riverside, San Diego, San Francisco, Santa Barbara, and Santa Cruz.

Several of the campuses have had university status for many years, and others have been newly established or have been elevated to university status within the last ten years.

The program set forth for libraries within the University is well described in O'Brien's article on the libraries of the nine campuses (1). The Voigt-Treyz article describes how the basic collection of 75,000 volumes for each of the new campuses was built (2).

Although each campus is essentially autonomous in internal organization and curricula, there is concerted effort toward cooperation among all campuses. This is especially evident among the libraries, for which a Master Plan has been developed.

The University's bibliographical resources are intended to function as a totality rather than as a group of separated and isolated segments. The sharing of resources by all campuses and the building of unique collections related to specialized academic programs on specific campuses are all part of the plan for library cooperation.

The Library Council and the Institute of Library Research (ILR) are the two agencies responsible for investigating and guiding these cooperative activities.

Automation is only one part of the total program and in general is under the guidance of the Institute of Library Research. Individual campuses have assumed responsibility for designing systems for specific processes, with one campus concentrating on one process. ILR serves as the coordinating agency.

The final system designed and implemented by each of the several campuses is intended to be one that the other campuses can adopt.

Since this type of cooperative project will not yield immediate results, the majority of the campuses are also engaged in library automation projects for their own use. Several of these, as well as the work of the Institute of Library Research, are described in this report.

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UNIVERSITY OF CALIFORNIA
INSTITUTE OF LIBRARY RESEARCH
BERKELEY AND LOS ANGELES, CALIFORNIA

SUMMARY

The Institute of Library Research (ILR), established in 1964, is a University-wide, academic, research organization to conduct research into library and information problems, to develop methods for the improvement of library and information systems, and to advance education for librarianship.

Although it has major commitments to the libraries of the nine campuses and to the two library schools of the University of California, its broader responsibilities extend beyond the confines of the University system. The program of ILR is based on the philosophy that each aspect of information services is part of the whole and that research, development, education, and operations cannot be isolated from each other.

The program of the Institute is divided into three parts: UCLA Research, Berkeley Research, and the Library Systems Task Force--the group representing each of the nine campus libraries of the University.

Each group is engaged in a variety of concurrent studies relative to the improvement of information services and the advancement of library education.

I. Background

The Institute of Library Research (ILR) was established in 1964 within the University of California as a University-wide, academic, research organization. Since the plan for the Institute stipulated that branches were to be maintained on each campus having a library school, offices of ILR are now located on the campuses at Berkeley and Los Angeles. Close association between the Institute and the two library schools is achieved and strengthened by joint faculty appointments, extensive interaction with doctoral students, and employment of M.L.S. students as research assistants.

Much of the initial impetus for establishing the Institute came from recognition of the magnitude of the problems inherent in the size and complex organizational structure of the University of California and the ambitious objectives set forth for library development and cooperation and for improvement of information service. The planned close association with the library schools is indicative of the recognized need to advance and coordinate library education and research. ILR thus has a major commitment to coordinate library systems research and development for all nine campuses of the University, as well as to participate actively in the educational programs of the two existing library schools.

In addition to these obligations as a University-wide organization, the Institute is also committed to a more general study of the basic problems of libraries and other information systems. This broader responsibility extends beyond the confines of the University system and is incorporated in the three-fold purpose of the Institute: (1) to conduct research into library and information problems; (2) to develop methods for the improvement of library and information systems; (3) to advance education for librarianship. Much of its work is intended to be applicable in other institutions and to lend assistance in finding solutions to problems on the national level.

For many years other schools of library science have had programs dedicated to library and information research. These research groups are, in most cases, integral parts of the library schools, but the working relationship between them and the libraries of the parent institutions differ from one institution to another. Through its coordinative role in the Library Systems Task Force group, ILR is much more extensively involved in the operational activities of all the campus libraries.

II. Philosophy, Concepts, and Research Plan

A detailed account of the research program of the Institute of Library Research appears in an article by Hayes entitled, "The Research Program of the University of California's Institute of Library Research" (5). The following brief summary of philosophy, concepts, and research plan is taken from that article:

A. Basic Philosophy

1. The approach is based on study of the needs for better information services, not just on the question of how specific techniques, such as the computer, can be used.

2. The approach is based on a total, integrated study of all aspects of information services, not just on fragmented studies of isolated aspects.

3. The approach is based on the integration of needed new services with existing ones.

4. The approach is based on the view of information services as a system problem, encompassing a variety of individual libraries and information centers into a unified whole.

B. Concepts

The concepts of the program stem from the basic philosophy that each aspect is part of the whole. Although research and experimentation in information science are recognized as essential to the fundamental aim of the research program, equally essential is the need to understand, to study, and to solve the problems in better information services as they occur in an operating environment.

C. Research Plan

The research plan is based on initiating research projects in areas of major emphasis in such a way as to produce an interrelating, mutually supporting set of studies. For purposes of description the projects have to be isolated, but in actual practice the entire program is considered as a whole and each area defined in terms of that whole. The specific projects are conceived as falling within six broad areas:

1. Values in library and information service--concern with the social and scholarly environment of the library and other information activities.

2. Library and information systems--concern with the nature of library and information systems, definition of their components, and the interrelationships of those components at various levels--local, university-wide, regional, and national. It is possible that this area has the greatest potential value. Examples of projects in this area are mechanization of library processes suitable for University-wide application and the utilization of bibliographical data produced by national agencies in machine-readable form.

3. Methodology research--concern with the development of basic methods by which libraries and information systems can be designed and evaluated.

4. Center for Information Services--concern with the development of a general-purpose capability for providing computer-based information services within the library, such services to be utilized by any university activity desiring to establish an information center; and concern with research into the problems involved in such a capability.

5. Social and professional impact--concern with the professional and social implications of the use of the computer for accumulating, storing, and retrieving information; and

implications for education in librarianship and information science.

6. Operations--concern with the pressing operational problems of the UC libraries, to be handled by a task force group coordinated by the Institute.

The role of the Institute of Library Research is viewed as that of a catalyst aiding the transfer of research results into improved practice and accelerating the rate at which the transfer occurs. This large, complex research program is much more pragmatic than many for it is based on the belief that research will have meaning to libraries only to the extent that it has a fundamental effect on the ways in which libraries carry on their operational tasks.

III. Projects

The magnitude of the entire research program necessarily requires that the objectives be reached and the work be accomplished by many separate but related projects. Each project and each task must have bearing on the basic philosophy and concepts.

The program of the Institute is divided into three parts: UCLA Research, Berkeley Research, and the Library Systems Task Force. Examples of some of the projects undertaken by each group are summarized below:

A. UCLA Research

1. Mechanized Information Services in a University Library--supported by NSF. (Phase I, Planning, is completed and Phase II, Specification and Programming, is now under way)

   a. Rationale

   Given a large number of magnetic tape data bases created in this country, e.g., MARC, MEDLARS, Chemical Abstracts, etc., should a university library acquire them and provide information services from them? Since libraries in the past have not had to consider this type of media, this study is concerned with library services for handling these different media and the problems libraries face in acquiring and cataloging such media and in providing "information services" based on them.

   b. Center for Information Services

   The vehicle for handling these media is conceived as a library-based "Center for Information Services." This project is directed toward specification of such a facility. The concept of the Center, engendered by the development of modern information technology, is unique in that such a Center is intended to handle only data produced in machine-readable form by other agencies rather than producing its own.

Organizationally it is conceived as an administrative part of the library, providing a supplement to the media and operations of the regular library. Physically it is a storage and processing facility embedded in a large complex network of computers.

In creating the capability to process nationally produced data bases and in tying into mechanized information networks, many policy and technical problems have to be defined and considered, and a number of basic questions have to be answered. For example, it is important to know whether the university library is the appropriate agency to acquire nationally produced data bases and provide information services from them.

c. Completion of Phase I, Planning

Begun early in 1966, Phase I was completed in December 1967. The second phase of this project has been initiated, but several important conclusions can already be drawn from the research completed in Phase I.

The university library is considered to be the appropriate agency for mechanized information services, but its traditional experience in serving the information needs of the community must be expanded to include the new sources. Even though the implication exists that large universities will connect their facilities in a common network and therefore have access to machine-readable data bases located in other agencies, university libraries as established areas of excellence must themselves become primary nodes in any "information network."

Outside sources are valuable for obtaining less-used data, but for those fields in which the library professes leadership, a university must acquire its own machine-processible files as they become available. In certain disciplines the newer media either equal or outrank in importance the more conventional media such as books. It is hoped that universities will be able to exploit machine-readable data in new and untried ways rather than limit their use to an extension of present conventional methods.

The final report, issued on completion of Phase I, gives a detailed account of this portion of the project.

It has been prepared in thirteen separate parts, with parts 1 through 8 comprising Volume 1 and parts 9 through 13 comprising Volume 2. Each part with author is listed under "Sources of Data" (17).

2. The Measurement of File Effectiveness--supported by NSF

   This study was concerned with the organization of large files particularly when data are uncertain or inaccurate.

3. Development of a Handbook of Data Processing for Libraries--supported by Council on Library Resources, Inc. (in process)

   This handbook is planned to bring together in an organized manner the existing diffused material relating to data processing in libraries to serve as an aid to the individual library.

4. Non-credit Extension Programs in Technical Information Services for Business and Industry--supported by State Technical Services Act and non-federal funds or fees

   The Director of the Institute of Library Research has been coordinator of a series of programs ranging from one day to thirteen weeks. Each is intended to instruct the participant in the use of technical information sources.

5. Education for Librarianship (joint UCLA and Berkeley)

   The faculty of the Institute of Library Research has contributed to revising the curricula in the two schools of librarianship and to realigning the courses for specific degree requirements.

   In addition to the traditional M.L.S. degree, UCLA now has an M.L.S. plus a certificate of specialization and an M.S.I.S. (Master of Science in Information Science) requiring a minimum of six quarters and emphasizing independent research. A Ph.D. program at UCLA is being developed. Berkeley already has a Ph.D. program but is developing a specialty in information science. This special program currently has ten doctoral students enrolled in it.

6. Additional Research

   Small but difficult and important studies pertaining to library operations and library education are conducted by the staff of ILR as the need arises. One study was concerned with developing criteria on which to project library budgets for the next decade or more. Another was to survey the needs of California for establishing another library school within the University system.

Such pragmatic studies enhance the value of the Institute's research program and are in accord with the basic philosophy and concepts.

B. Berkeley Research

1. California State Library--supported by contracts

Since 1965 the California State Library has used the services of the Institute of Library Research to conduct several studies in the area of technical processing and the preparation of book-form catalogs.

a. Feasibility Study

In 1965 the Institute provided a preliminary evaluation of the feasibility of mechanization of the State Library clerical processes. As a result of this review, ILR recommended the mechanization of serials control and an expansion of services offered by the State Library Processing Center. The Processing Center has been offering acquisitions, physical book processing, and catalog card production, all manually based systems, to subscribing libraries. The suggested processing facility would be a computer-based operation offering a full range of technical processes to libraries and library systems throughout the state on a contractual basis (15 p. 17).

b. Analysis of Book Form Catalogs

ILR also made an intensive investigation of the application of book-form catalogs to the State Library holdings. This work represented an extension of the work performed by ILR personnel for the Stanford University Libraries and the Council on Library Resources in 1964 (6). In the earlier study, the catalog format and entry size were taken as given and equations were developed to represent the cost of producing catalogs by various methods--computer, sequential camera, etc. In the more recent study for the State Library, extensive samplings of the State Library catalogs were taken and analyzed in order to be able to obtain statistically reliable statements of the impact on cost which the inclusion of each of the various fields of catalog information or the use of particular page formats would have (15, p. 18-19). The findings and conclusions of this comprehensive research study are included in the Cartwright-Shoffner report, Catalogs in Book Form (1).

c. California State Library: Processing Center Design and Specifications

As a result of the earlier studies, during 1968 ILR worked under contract with the State Library to develop the design and specifications for a Technical Processing Center. The long-range and open-ended goal of the Center is to provide computer processing services to libraries throughout California. The more immediate objectives which are both feasible and of tangible benefit to libraries within the State are:

(1) Retrospective conversion of card catalogs to a machine-form data base, compatible with MARC II.

(2) Continuing conversion of current cataloging to machine-form data base, compatible with MARC II.

(3) Incorporation of MARC II tapes, distributed by the Library of Congress, into the Center's data base for use in cataloging support.

(4) Production of book-form catalogs.

(5) Control of technical processing associated with serials, including ordering, check in, claiming, binding, accounting, and holding lists.

These objectives are controlled by three important frames of reference: (1) the Processing Center is intended to serve a network of participating libraries; (2) its operation is intended to extend in time beyond any conversion period and therefore its design must accommodate a full range of post-conversion services; (3) the existence of the Processing Center should not be dependent on any particular set of hardware or equipment.

The intended scope of the system is to offer services to a large network of subscribing libraries that need not be geographically or administratively linked to each other. Each may subscribe to the Processing Center's services on a simple cost basis without sacrificing local autonomy or independence. Details of the design, specifications, and cost analysis for the Technical Processing Center appear in a five-volume report (13).

2. Intercampus Facsimile Transmission Experiment--supported by Council on Library Resources, Inc., with additional financial and technical assistance from Pacific Telephone

and Telegraph Company, University of California, and Xerox Corporation

The Library of the University of California, Davis, had participated in an earlier experiment with the Reno and Las Vegas campuses of the University of Nevada, using Magnafax telefacsimile equipment for handling interlibrary loan materials (7,10).

Subsequent discussions with the Xerox Corporation led to the decision to conduct a similar experiment utilizing its faster but more costly LDX (Long Distance Xerography) equipment between the Berkeley and Davis campuses. The experiment was conducted for one month, with transmission in one direction only--from Berkeley to Davis. The major portion of the transmission consisted of journal articles (from volumes in the Berkeley Library) which were requested by faculty members on the Davis campus.

The study had a three-fold purpose: (1) the development of a viable set of procedures for use of telefacsimile equipment in a library environment; (2) the analysis of three specific elements and the relationship between them --performance of the system, the nature of current and future demand for the system, and the cost of the system; (3) the extraction of general principles for the design of a system for cooperating libraries, comparison of telefacsimile with other delivery systems, and recommendations for future research in this area.

The fact that the equipment is expensive and that this means of providing interlibrary services is costly came as no surprise to those conducting the study. But aside from the high costs, the experiment indicated a need for libraries to reorganize and improve their manual procedures needed for interlibrary loans regardless of whether they are handled the ordinary way or by facsimile transmission. The experiment also indicated that a period of one month is not long enough for faculty members to reorganize their work habits to take full advantage of the high-speed service which telefacsimile provides. Faculty members have built up their work habits over a period of years based on the current operating system for handling interlibrary loans and are not accustomed to having their requests handled in a shorter period of time.

A full account of the experiment is given in the Morehouse-Shoffner and the Schieber-Shoffner reports (11-12).

3. An Information Processing Laboratory for Education and Research in Library Science--supported by USOE

The motivation behind this project grew out of the heightened awareness of the impact of computers on libraries and librarianship. Library schools must educate and train a new breed of library scientists in order to exploit fully and apply intelligently information processing technology. The library scientists of the future must be intimately familiar with computers and information processing, and an information processing laboratory as an integral part of library education can provide a powerful vehicle for teaching and research in librarianship.

The purpose of this project as stated in the original proposal is to investigate the problems concerning the design, organization, operation, and evaluation of an information processing laboratory for library science students. The laboratory is to provide the tools for demonstration and use of information processing techniques, to explore the use of online computer-assisted instructional techniques for teaching both information processing and traditional librarianship, and to provide the equipment and facilities needed by advanced students.

Phase I of the program extended from July 1, 1967, to December 31, 1968. During this phase the work was concerned with planning and development of the Laboratory. The major planning task was to evolve the concept of the Laboratory in relation to the educational needs of the field; the development tasks provided the computer programs, data files, equipment, space, etc.

Education in librarianship must include both the applied and the theoretical; the Information Processing Laboratory is intended to fill both needs with emphasis on the theoretical. Planning thus far has resulted in definition of initial topics within librarianship to be supported by the Laboratory. This, in turn, has led to the development of computer programs for online interrogation and search and to the creation of data files on which to "exercise" these techniques.

As initial prototype capability was developed in two topics--associative search, related to intellectual access; and subject cataloging, related to more traditional course content. Programs have been written and routines developed for both topics, and online facilities are available.

A description of the project and details of the activities that took place during the eighteen months of Phase I appear in an interim report, "An Information Processing Laboratory for Education and Research in Library Science: PHASE I" (8). The report goes beyond a mere presentation of the current status of the project and discusses the current trends in librarianship and the implications for education.

During Phase II, the emphasis will shift from planning and preparation to student involvement in the Laboratory. Over-all systems planning will continue, directed toward student work within the Laboratory and toward determining the educational and research effectiveness of the Laboratory. Programs will be extended and expanded, and the scope of topics will be widened.

4. File Organization and Search of Bibliographic Holdings Records in Online Computer Systems--supported by USOE

To develop effective computer-based library systems, it will be necessary to understand the organization and research of large random-access files with terminal controlled interrogation.

The purpose of this project was to study the problems of file organization for an online system designed for the interrogation of very large files of bibliographic records. As part of the study, a data base composed of Roman alphabet materials (of general usefulness to the research library) in machine form is being established in a computer system with mass storage and terminals. Experiments such as actual user search requests are being designed to test various methods of file organization for an online interrogation system. There are two parts to the study: the development of the data base utilizing both existing machine-form records and original input; and the development and application of organization and search techniques in an online system. Phase I consisted of the initial development of the data base and planning of experimental interrogation techniques. The final report for Phase I was prepared by Cunningham, Schieber, and Shoffner (2).

The second phase of a continuing study is aimed at understanding the logical principles underlying the organization and search of large random-access bibliographic files with terminal-controlled interrogation. Work during this phase includes the continued development of the data base begun in Phase I, establishment of the experimental facility, and execution of the identified organization and search experiments. Finally, the study is anticipated to be a continuing one, and the systems planning for over-all organization and performance of the study will continue.

5. Context Information Processing--supported by NSF

The premise of this study is that neither the information conveyed by a document nor the information needs of a library patron can properly be identified solely on the basis of index tags (subjects, e.g.). There are important additional data about each and about the relationship between the two which can be obtained only from an analysis of their context. If context information were identified, formalized, acquired, and stored, it could then be used to enhance both traditional and mechanized search techniques. The approach to this issue has been to study the use of background information about authors (their affiliation, colleagues, etc.), journals (their policies, subject emphasis, etc.), cited papers, and so on in order to determine how such data might be processed in a literature searching system. Three related reports describe the project (3,9,16).

C. Library Systems Task Force--supported entirely by University funds

The Library Systems Task Force consists of library systems analysts and programmers representing each of the nine campuses of the University plus ILR advisory members. The primary purpose of the group is to work directly with, or as consultants to, the staff members of the several libraries on specific problems for which common and consistent University-wide solutions are sought. In addition to its advisory function, ILR frequently serves as a development agency for software and systems, based on specifications supplied by the campus analysts.

1. Specific Task--development of mechanized clerical systems in the library

The Task Force is not attempting to carry on all library-related automation work for the entire University. Some projects, even though they may have University-wide applications, can be done better within individual libraries. For these the Task Force coordinates and assists the development of systems which will have application on several campuses.

In response to a request from the University President, the Task Force group has put together a comprehensive five-year library mechanization plan. This plan calls for a three-phase development scheme: (1) batch processing performed directly at each campus library; (2) online processing to be performed at local campus computer centers; and (3) online processing performed at a single bibliographic center. The mechanization plan includes an organizational structure in which planning responsibility is allocated to the Library Council (i.e., the nine campus Librarians); the preparacion of technical specifications and requirements is the job of the local campus analysts, and actual programming and software system design is carried out by an independent ILR staff group.

2. University of California Union Catalog Supplement: 1963-1967--supported by the Regents of the University

As a project related to the Phase III task of the Library Systems Task Force mechanization plan, ILR-Berkeley will produce the first Supplement to the University's Union Catalog (which was first published in 1963). This Supplement is the first of a series and will include over 800,000 unique titles, representing cataloged acquisitions of the nine campus libraries during 1963-1967. The purpose of this project is to produce a book-form Union Catalog by converting the bibliographic records of these new holdings to machine form and to use computer techniques for its production. It is estimated that the Catalog will contain over 800,000 unique entries.

To achieve maximum value and re-use of the machine record, the system will produce a MARC II structure record. This MARC II machine record is created by an approach termed Automatic Field Recognition, in which no pre-tagging scheme is required. Instead, computer algorithms work with the natural format of the catalog card to identify MARC-defined bibliographic data elements.

Conversion of the card file will take place during 1970. Printing of the actual catalog is scheduled for January, 1971.

The various projects undertaken by ILR cover a broad range of activities, but all are interrelated and mutually supporting. These examples give some indication of the type of activities which are encompassed within the Institute's aims and basic philosophy.

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UNIVERSITY OF CALIFORNIA
LIBRARY
IRVINE, CALIFORNIA

SUMMARY

The Irvine Campus of the University of California, opened in October 1965, is entirely new and not yet completed. From the beginning, UCI has been planned as a computer-oriented campus with a curriculum which encourages individual programs and independent study.

The Library Systems Analysis Office (LIBSANOFF), is the supporting arm of the Library to design and implement a total system and to coordinate the Library's computerization activities. SPOTS (Serials Printout System) is operational. Other subsystems of CALM (Computer-Assisted Library Mechanization), the total system planned, are in various stages of development.

I. Background

This totally new campus is part of a unique city-industrial-educational complex rising from the old 88,000-acre Irvine Ranch in Orange County, south of Los Angeles. Original planning began in 1961, and the University opened to 1,500 students in October 1965 with eight of its main buildings and a group of residence cottages completed. Student enrollment including freshmen through postdoctoral was 2,800 in 1967-68, and is projected to 10,000 in 1975 and 27,500 in 1990. Besides the undergraduate College of Arts, Letters and Science and the Graduate Division, the campus also has two professional schools --the School of Engineering and the Graduate School of Administration. The California College of Medicine, of the University of California, is also being relocated from Los Angeles to become the medical school of the Irvine campus.

The Library, beginning with no collection, had 150,000 documents in 1967-68 and is planned to grow at the rate of 55,000 volumes each year for the next five years.

II. Objectives

From the beginning, UCI has been planned as a computer-oriented campus, using the computer not as a "dehumanizing" machine but as an invaluable tool which supplements the book and assists in instruction. The curricula of its many departments stress a broad range of electives with a minimum of requirements and encourage individual programs and independent study.

The time-sharing software for this very ambitious program of computer usage has been designed and implemented by a joint contract between IBM and the University, which ended in February 1969. It incorporates the work of several divisions and offices, e.g., Library, Registrar, Instruction, and is to interrelate the data created by each one to form a campus-wide information system. The Library, as one of the large subsystems of the Campus plan, has the following stated objectives:

A. To be a part of a campus-wide information system designed so that other offices on the Campus can access data created by the Library and so that the Library can access data created by others on the campus.

B. To plan the computerization of its procedures from a total system point of view based on an online, real-time system operating in a time-sharing environment.

C. To use a modular approach to the implementation of procedures, i.e., working on some small segment of the total planned system, perhaps some single procedure. Each segment or single procedure, standing alone, can become operational but also be incorporated later into the total plan.

D. To incorporate within its system, data banks created by other organizations such as the MARC tapes of the Library of Congress and the MEDLARS tapes of the National Library of Medicine.

E. To conduct a continuing program of research and development in library operations. The Library is not bound by past tradition or set patterns.

F. To serve the following major categories better than the manual system has:

1. Management

Obtain more information for more effective decision making; achieve the eventual reduction of total operating costs; make more effective use of funds; handle increasing acquisitions without a substantial increase in processing costs; increase efficiency in processing and recording incoming materials.

2. Personnel

Release librarians from the mundane routines; enable librarians to engage in truly professional activities; upgrade the support staff positions and utilize them more effectively; eventually request fewer personnel.

3. Records

Eliminate, when practical and possible, any manually maintained files; reduce and/or eliminate the number of forms necessary for processing.

4. Services

Increase services to patrons such as selective dissemination of information and instant status reports; provide more rapid access to the collections; increase rapidity with which bibliographic resources are made known to the faculty and staff.

III. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

The Computer Facility on the Campus opened with an IBM 1410-1440 time-sharing system with 20 online IBM 1050 typewriter terminals operating in a real-time, interactive mode.

This system has been replaced by an IBM 360/50, an online, real-time system. The peripherals include disk packs, tape drives, a high-speed printer, IBM 2260 CRT (Cathode Ray Tube) terminals and 40 IBM 2741 typewriter terminals located throughout the Campus.

Interactive Applications Supervisor (IAS), developed by the joint UCI-IBM Project, is the time-sharing monitor under which the Library system will operate. Programs for the Library's system are being written in IBM 360 assembler language, which is required by IAS in order to provide re-enterable programs in core.

Some of the typewriter terminals and the CRT's are planned for location in the Library for various procedures as described below.

B. Personnel

Prior to late 1966 work for the Library was performed by a Senior Programmer from the UCI Computer Facility. Then late in 1966 the LIBrary Systems ANalysis OFFice (LIBSANOFF) was established to assume responsibility for designing and implementing a total system known as Computer Assisted Library Mechanization (CALM) and for coordinating all of the Library's computerization activities with other campus and University computerized systems. The Office is headed by a librarian with the title "Library Systems Analyst and Computerization Coordinator." He reports directly to the University Librarian and supervises programmers and other librarians assigned to this office.

When the system reaches peak development, it is estimated that as many as eight programmers and three librarians will be needed to support the system. LIBSANOFF is not an operating data processing unit for day-to-day activities, but rather a staff unit with design and developmental functions to support the library operations.

IV. Activities

A. Serials

1. SPOTS (Serials PrintOuT System)--Operational

   a. Developed and programmed before LIBSANOFF was established, this program became operational in April 1966. It is based on the serials system developed, implemented, and operated by the Library of the University of California at San Diego. SPOTS is a computerized printout of UCI's bound periodicals and bound/unbound continuations holdings. It is not a check-in system for currently received issues. Regular printouts include:

      (1) PUBLIC LISTS giving a limited amount of information sufficient for public use.

(2) MASTER LIST giving all defined data for each title for staff use. Punched cards were used for input and for record storage.

b. At the time LIBSANOFF was established (late 1966), redesign and reprogramming of SPOTS became necessary because:

  (1) IBM 360/50 Computer replaced IBM 1410-1440.

  (2) Punched card file was becoming too cumbersome.

  (3) There was a need for greater efficiency and improved output.

Although reformatting the record layout would have been desirable, limitations of time, personnel, and funds did not permit the necessary rekeypunching of 4,000 titles. Instead, several more modest but useful changes were made to permit:

a. Printout by classification number (shelf-list).

b. Reformatting the printout for a more attractive page.

c. Adding some additional data in previously unused data fields.

d. Storing on magnetic tape instead of on punched cards.

2. SEGREMS (SErials Graphic REcord Management System)--Experimental and partially Operational

Development of this system began in October 1967 to be used in conjunction with SPOTS. It is an online, real-time system with remote CRT (Cathode Ray Tube) terminals, known as IBM 2260 Display Station, located in the Library. SPOTS magnetic tapes, containing all defined data for each serial title, are read onto disks; the records on the disks are updated from the Library through the CRT; the updated records on the disks are read into a new magnetic tape for use in SPOTS printouts, a batch processing system. This procedure eliminates keypunching the changes to update the next printout.

Since the SPOTS tapes have a complete and up-to-date record of each serial title, these tapes also provide back-up for SEGREMS in the event of temporary failure. In addition to updating SPOTS, SEGREMS also permits users to address the file through a remote CRT Terminal to retrieve a serial record or to browse through the file. An IBM 2260 terminal was installed in the Serials Department in October 1968. With this installation, the update module of SEGREMS became operational in December 1968.

The next steps in developing SEGREMS are:

a. To add new titles to SPOTS; this is now done by keypunching cards.

b. To delete undesired records from SPOTS; this is now done by keypunching cards.

c. To have the CRT display all records changed since the last reporting cycle and before any new reports are generated.

d. To incorporate SEGREMS as part of the serials subsystem which is to be developed as a part of the total library system, CALM (see below).

B. Computer-Assisted Library Mechanization (CALM)

This is the total system planned for the Library as an integral part of an eventual campus-wide information system. Implementation of all subsystems will take place over a period of several years. Ultimately there is to be a LIBRARY DATA BANK serving all Library subsystems. Ideas include the use of campus data banks and outside information data banks, such as the MARC data and L.C. Subject Headings in machine-readable form. Most of the system is now in the development stage.

1. Design of the System

a. To be an online, real-time system operating in a time-sharing environment with remote access typewriter terminals and cathode ray tubes.

b. To handle the operations of a large university research library with provisions made for the other campuses of the University to use the system.

c. To capture data for a given title as soon as possible to eliminate repetition of entering the same data more than once; as processes are completed, the record will be updated. A processing document will accompany each title from acquisitions to shelving.

d. To be as simple as possible, flexible, and open-ended; and to take advantage of technological developments, i.e., remote terminals.

e. To be divided into several subsystems and each subsystem, in turn, divided into MODULES.

2. Major Activities to be included in CALM

a. Acquisitions Subsystem

This is the first major subsystem to be designed. Within the context of the Operations Task Force of the University of California Institute of Library Research set up for the nine campuses, the UCI Library is responsible for Acquisitions.

(1) BOok Fund ACcounting (BOFAC)

Even though BOFAC is not the first step in acquisitions, it was selected as the first module to be implemented because it is relatively simple and internal, it will not affect the public, and it will give the Library an opportunity to test the system and the various online devices--IBM 2741 typewriter terminals for data input/output and IBM 2260 cathode ray tubes (CRT).

This module will provide automatic encumbering; disencumbering; conversion to foreign currency; encumbered balance; reports by fund; weekly, monthly, and annual reports; and statistics of various kinds.

This is a "stand alone" accounting system until such time as a bibliographic record layout is developed. The specifications for BOFAC have been determined, eight modules have been identified, and a general design has been drafted.

(2) Bibliographic Checking Stage (to come)

After a request is approved, a bibliographic check is made. At this point MARC tapes will be used in the checking. If on the tape, data will be retrieved and entered into the system. If not on the tape, processing will follow regular channels.

(3) Preparation of Purchase Orders (to come)

(4) Bibliographic Record Layout Subsystem (to come)

b. Cataloging Subsystem (to come)

This subsystem will be dependent upon the design of the bibliographic record format. MARC records will be used when available; otherwise original cataloging will be done. The class number, subject headings, and other data will be added to the existing record as needed. Permanent form of the future catalog is not yet known. Possibilities are book catalog, card catalog, combination of book and card, computer-stored catalog with remote access, and a combination of computer-stored catalog for newer entries and card catalog for older ones.

c. Inquiry Subsystem (to come)

A patron can access the file by author or title or subject to get a status report on a title--on order, in process, circulating, etc. If the title is not in the file and the decision is made to obtain it, the first data pertaining to the title are entered into the system in order to produce the processing document, or "request card" as it is presently called.

d. Circulation Subsystem (to come)

The UCI Library does not want book cards but would like a machine-readable borrower's card and machine-readable book label, both of which would be used in order to charge out books. The hardware to implement this concept does not appear to be available as yet.

e. Serials Subsystem (see above)

(1) Incorporate SEGREMS into the serials subsystem.

(2) Include a check-in system using CRT's.

To eliminate big tubs of arrival cards, which some systems now have, an idea being considered is to have a Master Card, such as a credit card, for each serial title. As an issue arrives, the Master Card would be pulled and inserted in an online data collection unit; the CRT would display the issue number which the library should have. This would eliminate direct input when the arrived issue matches the computer entry.

V. Costs

Since this is a new library, there are no long-established manual procedures with which to compare costs. The cost of computer CPU (Central Processing Unit) time will be an estimated $180 an hour. Much of the Library's work will be accessing the file by a typewriter terminal or CRT. It is estimated that 50 hours of CRT work equals one hour of CPU time. Other charges to be made by the Computer Facility are yet to be determined.

VI. Sources of Data

1. Ahn, Herbert K. Libraries and Automation. Address delivered to the Library Staff of California State Polytechnic College, San Luis Obispo, California. October 6, 1967. 16p.

2. Sheldon, David N., and Ahn, Herbert K. Computer-assisted Library Mechanization--CALM/360: Serials Graphic Record Management System (SEGRAMS). November 10, 1967. 11p.

3. Site Visit in January 1968. Interview with Mr. Herbert K. Ahn, Library Systems Analyst and Computerization Coordinator.

Personal Communication with Mr. Ahn, 1969.

UNIVERSITY OF CALIFORNIA
BIOMEDICAL LIBRARY
LOS ANGELES, CALIFORNIA

SUMMARY

The Biomedical Library of the University of California at Los Angeles (UCLA) is a special library in an academic environment. As one of the large biomedical libraries in one of the largest universities, its collections are broad in scope and its services are extensive.

The major activity in library automation is a SERIALS CONTROL SYSTEM, which is operational. Just recently the Library received a grant to convert serials operations to an online system. The subject heading authority list is now being keypunched; and the serials holdings lists for UCLA Biomedical Library and the Library of the University of California, San Francisco are in the process of being merged.

As one of eight Regional Medical Libraries (RML) in the country, the Library is the center for the Pacific Southwest Regional Medical Library Service, serving Arizona, California, Hawaii, and Nevada. It is also a MEDLARS Search Station.

The Library operates a pilot project of the Regional Medical Programs (RMP) for California Region Area IV (UCLA)--the Medical Information Communication System. In addition, it shares with the School of Medicine responsibility for the Brain Information Service (BIS), an NIH-sponsored project.

A circulation system for all libraries of UCLA is now being developed. In the future the Biomedical Library plans to become a part of this system.

I. Background

The Biomedical Library serves primarily the Schools of Medicine, Dentistry, Nursing, and Public Health, the teaching hospital and related institutes within the UCLA Center for Health Sciences, and the upper classmen and graduate students in the Departments of Bacteriology, Zoology, and Botany in the College of Letters and Science. The collections are broad in scope and consist of approximately 235,000 volumes and over 12,000 periodicals of which more than 6,000 are current titles.

As one of the largest biomedical libraries in the country, it provides a number of regional services. One of eight Regional Medical Libraries (RML) in the country, it is the center for the Pacific Southwest Regional Medical Library Service which serves Arizona, California, Hawaii, and Nevada. It is also a MEDLARS Search Station.

The Library operates a pilot project of the Regional Medical Programs (RMP) for California Regional Area IV (UCLA) known as the Medical Information Communication System. In addition it shares with the School of Medicine the responsibility for the Brain Information Service (BIS), an NIH-sponsored project.

II. Objectives of the Control System for Serials

A. To provide better service to the Library's patrons.

B. To attain a tighter control of existing records.

C. To serve as a pilot project in the area of automated library record keeping.

III. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

The Health Sciences Computer Facility, located in the same building complex, houses the computers and related equipment. The first computer was an IBM 7410, followed by an IBM 7040-7094 direct couple configuration; later an IBM 360/75, and now an IBM 360/91--the largest of the series. In addition, there are keypunches and such unit record equipment as interpreting keypunches, sorter, collator, and IBM 407 accounting machines for listing purposes. All programs for the Biomedical Library's Serials Control System are in COBOL and PL/1.

The Library also uses the University Hospitals IBM 360/40, and printing is done on the University Library's IBM 360/20.

The Biomedical Library itself has keypunches for preparing the input.

B. Personnel

The systems staff of the Library consists of a librarian, 2 programmers, a coder, and 1/4 time of a secretary-keypuncher.

IV. Activities

A. Serials Control System--Operational (3, 4)

Present holdings consist of 12,000 titles, of which 6,000 are active. Development of a serials control system began in 1963 when the Library received a General Research Support Grant from the UCLA Medical School; since then funds have come from a Medical Library Resource Grant which expires in 1971.

As of September 1, 1968, checking in on the Kardex (manual) file was eliminated. Until the computer check-in system was tested and working well, the Kardex file was maintained; upon its elimination the workload of the Serials Section was reduced by one full-time employee.

1. Essentials of the System

a. Format

Within the past year all serials records have been converted to a MARC II-type format.

b. Input

The original record including holdings is first entered manually on an input sheet from which cards are keypunched and read into the computer for storage on magnetic tapes.

c. Publication Patterns

The publication pattern scheme essential to this system is unique and resulted from a previous study made of the publication patterns of scientific serials (1). Each active serial is classified in one of some 18 possible publication patterns implying predictability; this stored information enables the computer to generate a check-in card predicting the next expected issue to be received by the Library regardless of when that will be. A more recent article by Roper explains the mechanics of the system (5).

d. Check-in Card

A "tub file" of pre-punched computer cards is maintained by the Serials Section. This file contains one card for each current serial in the Library, regardless of when the next issue is expected to arrive. The card is punched with abbreviated title, abbreviated call number, year, volume and issue of the NEXT EXPECTED ISSUE. Each week the deck of cards representing the issues which arrived during the past week are read into the computer for updating the Holdings Record and generating a new check-in card for the next expected issue. The cards for the issues which arrived during any one day are also used to produce a daily receipts list. At the present time over 600 periodicals arrive each week.

e. Bindery Information

The check-in card of an arrived issue updates the Holdings Record. If that issue completes a "binding volume," a BINDERY NOTIFICATION CARD is generated. The system also produces bindery preparation slips and bindery pickup lists. Various statistical counts can be made as needed.

f. Claim Card and Letter

Provision has been made to notify the Serials Librarian when no transaction has taken place for a title for a given period of time. A claim letter can be produced; and when the missing issue(s) arrives, a punched card updates the record.

g. Holdings Record

This is the Master Record stored on magnetic tape. It contains full descriptive data about each active and inactive title and complete holdings. The tape includes title; country of origin; pattern information; subject and language codes; status--current, dead, on order; cross references; notes; call number; routing codes; location; how received; retention code; agent code; holdings of bound/unbound, complete/incomplete volumes and years.

2. Output

a. Daily Program Runs

(1) Daily receipts list cumulated
(2) Daily list of bindery slips processed

b. Weekly Program Runs

(1) Weekly cumulation of receipts
(2) Master update; printed output from this program includes:

    (a) a list of all input and output cards
    (b) a list of all records altered during the run
    (c) an error list
    (d) separate lists of new entries, deletions, various totals, etc.
(3) List of all current serials for serials department use
(4) Reference desk list for use by reference librarians and the public

c. Monthly Program Runs

(1) MAP list--list of the entire file for internal use only
(2) Claims list--list of journals for which claim action is indicated
(3) Special on-demand lists by subject, language, etc.

A monthly cumulated receipts list was produced for a time but discontinued because of insufficient demand.

3. Online Development

As of July 1, 1969, the Library received a research grant for an online serials project. The design is being prepared, and the Library is in the process of ordering equipment.

B. Subject Heading Authority List

The subject heading authority list is now being keypunched. The Library's own subject headings plus ~~those~~ from MESH and LC will be used.

C. Combined Serials List

The serials holdings lists of the UCLA Biomedical Library and the Library of the University of California, San Francisco (a medical school) are in the process of being merged and put in machine-readable form.

D. Information Retrieval Services--Operational

1. MEDLARS Search Station

2. Brain Information Service

Since these services are outside the scope of this report, the reader is referred to Darling's account of these projects (2). Although the citation is several years old and the projects have undergone many changes, it is a description of actual operating information services.

V. Future Plans

The Biomedical Library will eventually tie into the UCLA Libraries' circulation system. The university-wide system is planned to be online and will require the use of book cards. (See also University Library, University of California, Los Angeles)

VI. Special Problems and Staff Suggestions

A. The Computer Facility has had four different computers since the Serials Project began. This in itself has caused programming, scheduling, and operational problems for the Library. In addition, the Computer Facility is used primarily by the research community. In the interest of experimental research, its staff makes changes within the computer from time to time to satisfy the needs of various research projects but does not notify the Library. Some of these changes seriously affect the Library's operations. This fact and the inaccuracies found in the Library data processed in the beginning prompted the Library to maintain its Kardex file until the Fall of 1968.

B. The Library Staff strongly recommends that:

1. a library should have its own programming staff.
2. a library should have access to a computer used for business applications rather than research; if a large library, it might consider having its own computer.
3. a library should always maintain a file of backup tapes in the event of careless handling.

VII. Sources of Data

1. Bishop, David; Milner, Arnold L.; and Roper, Fred W. "Publication Patterns of Scientific Serials," American Documentation. XVI, April 1965. p. 113-122.

2. Darling, Louise. "Information Retrieval Projects in the Biomedical Library, University of California, Los Angeles." In: Proceedings of the 1966 Clinic on Library Applications of Data Processing. Herbert Goldhor, ed. Urbana: University of Illinois Graduate School of Library Science. 1967. p. 91-123.

3. Fayollat, Jim; and Luck, Don. *Summary Report on the UCLA Biomedical Library Control System for Serials.* Multilithed report. October 1968. 12p.

   and

   Fayollat, Jim; and Luck, Don. *Summary Report on the UCLA Biomedical Library Control System for Serials.* Multilithed report. October 1967. 11p.

4. *Procedure Manual.* n.d. 46p.

   and

   UCLA Serials Project: Data Bank and Data Element Facts. n.d. 5p.

5. Roper, Fred W. "A Computer-Based Serials Control System for a Large Biomedical Library." *American Documentation.* XIX, April 1968. p. 151-157.

6. Site Visit in December 1967. Interviews with:

   Miss Louise Darling, Biomedical Librarian
   Mr. Nelson Gilman, Assistant Biomedical Librarian
   Mr. Don Luck, Head, Technical Processing
   Mr. Jim Fayollat, Head, Programming Unit
   Mr. Robert Braude, UCLA MEDLARS Station
   Dr. Peter Amacher, Brain Information Center

   Personal Communication with Miss Darling and Mr. Gilman, 1969.

UNIVERSITY OF CALIFORNIA, SAN DIEGO
LIBRARY
LAJOLLA, CALIFORNIA

SUMMARY

The Library of the University of California, San Diego, working in conjunction with the Computer Center, developed one of the first operational computerized systems in a university library--SERIALS COMPUTER PROJECT. Although the project has undergone numerous revisions, reprogramming, and changes in computer equipment, the basic logic remains almost the same as originally designed.

As one of the new campuses of the University of California, it is working closely with the other campuses to develop compatible processing systems.

I. Background

The University of California, San Diego (UCSD), is considered one of the "new" campuses of the University system although the Scripps Institution of Oceanography (SIO), begun in the late nineteenth century, formed the nucleus for the new general campus plans in 1958. The first graduate program began in SIO in 1959. With this nucleus of graduate students, UCSD established an undergraduate program and additional graduate programs in the Fall of 1964. The Campus will eventually include twelve semi-independent colleges, each with its own undergraduate and graduate programs, as well as a medical school.

Since San Diego is now the largest metropolitan area in the country without a research library, it is planned that UCSD will have a great research library to serve both the graduate and undergraduate student body and the community.

The library grew from 30,000 to 300,000 volumes in five years (1961-65), providing a basic undergraduate collection of 75,000 volumes and building up the graduate and research collections in several subject areas. The collection has now grown to 600,000 volumes.

At the present time processing is centralized for four of the five libraries: the Central Library and three branches--Scripps, Science and Engineering, and Cluster 1 which has a general collection. Processing for the Biomedical Library is separate.

II. Objectives (as expressed in the proposal of August 31, 1961)

A. To use computers in library operations at UCSD. The Library is in a good position to begin projects because:

1. The size of the Library and its intake of publications is relatively small, thus problems are simplified and analyses and improvements can be made more easily.

2. The University already has a well-established and efficient computer facility with a well-qualified staff.

B. To choose serials for the initial computer project because:

1. Serials records are among the most difficult and costly to develop and maintain.

2. Records maintained by traditional methods are difficult to use and are not accessible to the library user except through a library staff member (in contrast to monographs which are accessible directly through the card catalog).

3. Serials are the most important materials in the sciences, and, with the emphasis on science on this campus, serials records are most in need of immediate improvement.

C. To develop a serials system not as an experiment but as an operational system which will be versatile and regenerative (hand operations kept to a minimum), and which can be adopted by other libraries.

III. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

1. In the Computer Center

Prior to 1965 the equipment available was: Control Data Corporation 1604 Computer with CDC 1612 high speed printer; CDC 160-A Computer; IBM Card Reader/Punch; keypunches; IBM 407 Accounting Machine and other unit record equipment. The programs available for Library use were: CDC FORTRAN Programming System--1960; CDC FORTRAN Programming System--1962; CDC 160-A OSAS-A Assembler.

In 1965 the older computers were replaced with a CDC 3600 scientific computer, which also used FORTRAN.

In 1968 an RCA Spectra 70 model 45 (an administrative computer) was added, using COBOL. As of March 1969, the serials system had been completely reprogrammed with about 80% of the operations on the RCA Spectra and the remaining on the CDC 3600. By September 1969 the RCA computer was gone and all processing was being done on the CDC 3600.

In the near future another change in computers will be made--first to the Burroughs 5500 and later to the 6500.

2. In the Library

A keypunch located in the Library is used for initial keypunching and corrections. Proofreading is done by the Library staff.

B. Personnel

Relationship with the Computer Center has been very good. The Center has always made an effort to keep the Library informed about its plans. In the beginning the Center assigned one programmer responsible for Library operations. The Library now has its own programmer.

IV. Activities

A. Serials Computer Project--Operational

The UCSD Serials Computer Project was one of the first computerized systems to become operational in a university library. Familiarly known as the San Diego System, it has been widely copied by other libraries.

The collection consists of over 16,000 serial titles with about 10,000 active. Since the Library is in a period of rapid growth, more titles are being added each year than in most established libraries.

Because the details of the project including the computer programs have been so well documented in two reports--an interim report prepared in July 1962 (1) and the final report prepared in May 1964 (2), this summary mentions only the highlights and the major revisions since the final report was issued.

1. August 1961--Present

From the beginning the data for each serial title were input into the computer on punched cards and transferred to magnetic tape for processing and storage. Very wisely the Library defined its output requirements and design before determining the input data. After the input elements were determined, the manual records were consolidated and an Intermediate Serial Record (ISR) form was designed. An ISR form is prepared by the Library staff for each copy of each serial title and is used as the source record by the keypuncher.

A variety of computer programs were prepared and initial experimental tests were run first on 100 titles and later on over 700. By this time the system was ready to become operational. Programmed updating procedures for current and back files were available and could provide current receipt and total holdings outputs. Another 800 titles were added by mid-1963 and by Fall 1964 the system contained 5,000 titles.

It is believed that this library was the first to use the "arrival card" system to check in individual issues. Once a serial record was entered on the master tape, the computer system produced a punched update card for each regular issue when a card for the last issue was returned to the system. When an issue arrived, the punched card was pulled from the file and placed in an "arrived" file until such time as the magnetic tape was updated.

This project has always proceeded on the premise that even an operational system cannot remain static but must continually be reviewed, evaluated, and improved to strengthen the operations. Between 1962 and 1964 the Intermediate Serial Record was redesigned to reflect the needs of the Library, programs were rewritten and improved, and new routines and outputs were incorporated. Since then, reprogramming has been necessary because of the changes in computers; minor changes have been made in day-to-day operations for greater convenience and efficiency.

2. Present

Today the logic remains much the same as was reported in the 1964 Final Report.

a. Original Input

Titles are cataloged on receipt of the first issue. Each copy of each new title continues to be entered on the Intermediate Serial Record by a member of the Library staff; from the ISR, cards are keypunched in the Library and taken to the Computer Center to be read onto magnetic tape. This tape contains the MASTER LIST of complete holdings and is updated every month.

b. Check-in of Individual Issues

Check-in of individual issues is now done on a list rather than using "arrival cards." The list is then used as a guide to pull the "arrival cards" for the issues which have arrived. Periodically these are sent to the Computer Center for updating the files and generating new "arrival cards." This system also provides for local check-in at branch libraries.

c. Output

(1) Master Tape Listing--monthly

This is a listing of all the serial records linearly arranged in alphabetic order by title, reproducing all of the information on the tape for each serial. It is for internal use only as proof sheets and to assist serial clerks.

(2) Union or Complete Holdings List--monthly

The complete history of each title, including call number, holdings, notes, see references, and added entries, is given and location is identified. It is divided into several bindings for easy reference.

(3) Updated List of Holdings for each Branch--monthly

The format resembles the Union List except that instead of library location the location within each library is shown. It is believed that this may be the most useful of the printouts for public use.

(4) Daily Listings of Arrivals

These are cumulated daily into weekly and then into monthly.

(5) Bindery List

This list is generated by the computer on demand or as part of monthly update procedure.

(6) Periodic Listings

These lists assist the Acquisition Department in placing subscriptions.

Originally, carbon copies were made of computer printouts for distribution. More recently the computer printouts are photocopied and reduced by commercial Xerox to produce copies in a smaller format.

B. Other Projects--Operational

1. The subject authority list for the Catalog Department is on the computer and provides updated lists of subject headings and cross references for the use of catalogers.

2. Much of the desiderata list in acquisitions is on the computer, allowing for production of want lists by subject, language, data, dealer, etc.

C. Other Projects--In Progress

1. Systems analysis has been completed for a computerized acquisitions system to include book accounts and bibliographic control.

2. Circulation is to be started within the next year, hopefully without the use of a book card.

V. Future Plans

A. The next step will probably be to go to a disk system and ultimately to an online system.

B. The San Diego, Davis, and Riverside campuses of the University have been cooperating in the field of serials processing, and it appears that formats and much of the programming will soon be the same on all campuses.

C. The Task Force of the Institute of Library Research at Berkeley is becoming more involved in the campus plans; eventually uniform systems may be developed for all campuses, with each library having the same kind of small computer.

VI. Costs

Careful cost records have been maintained since the beginning of the project. Costs were discussed in both the interim and final reports and in a panel discussion in 1963 (4).

VII. Special Problems

A. The rather frequent change of computers has necessitated considerable reprogramming.

B. The Serials System has had to be expanded to increase its updating capacity; also the Master tape reached the point where the total file has had to be divided.

VIII. Sources of Data

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3. Vdovin, George; Voigt, Melvin J.; Newman, David; and Perry, Clay. "Computer Processing of Serial Records," Library Resources and Technical Services. VII, Winter 1963. p. 71-80.

4. Voigt, Melvin J. "The Costs of Data Processing in University Libraries--Serials Records," College and Research Libraries. XXIV, November 1963. p. 489-491.

5. Site Visit in December 1967. Interviews with:

   Mr. Melvin J. Voigt, University Librarian
   Miss Nancy Corbin, Serials Librarian
   Mr. John Kelley and Mr. Earl Balch

   Personal Communication with Mr. Voigt, 1969.

UNIVERSITY OF MISSOURI
THE UNIVERSITY LIBRARY
COLUMBIA, MISSOURI

SUMMARY

The University of Missouri Library began using data processing equipment in 1949, giving it one of the longest unbroken records in the use of this equipment in a university library. The Library may also have been the first within a university to acquire and manage its own computer.

At the present time all acquisition documents related to books and periodicals, catalog card production, and circulation control are computer based.

As an original participant in the MARC Pilot Project, it has utilized the MARC tapes to prepare catalog cards and has experimented in various ways in anticipation of using MARC data as a standard source of bibliographic data in the future.

The School of Library and Information Science is undertaking a research and development program for the creation of a computer-based online bibliographic information system for use by all four campuses of the University. Such a system will require acquisiton of a larger, third-generation computer with real-time, remote access capabilities. When the project becomes operational, it will be turned over to the libraries of the University system.

Future plans include participation in the development and implementation of regional and national network systems.

I. Background

The University of Missouri Library, Columbia, is a large university research library with close to 1.5 million volumes. The collection is contained in a main building with eight subject divisions and eight branches, each with its own card catalog, so that seventeen separate card catalogs are currently being maintained.

Since becoming a research library in 1957, the Library's rate of acquisition has more than doubled and the need for improved processing methods increasingly imperative. As an early user of data processing equipment, the Library has continually updated its operations to meet the increasing needs.

The School of Library and Information Science is working closely with the Library in research and development projects. At the present time there are four campuses of the University; and in the future, it is expected that all four will have access to a single computer-based online bibliographic information system.

II. Facilities for Automation--Hardware, Software, Personnel

It is possible that this Library was the first to acquire a computer primarily for its own use. The small-scale computer, installed in the Library in 1966, is an IBM 1440 with 8K storage, card read-punch, printer, magnetic tape drive, paper tape reader/punch, and four disk storage drives. There are also Friden Flexowriters, keypunches, and four IBM 357 Data Collection Units. In addition to this equipment, the Library has access to the computer equipment in the University Data Processing Center.

The Library maintains its own staff and prepares the necessary programs for the projects. Assistance is available from the staff of the Data Processing Center and the School of Library and Information Science.

III. Activities

The University of Missouri Library has used data processing equipment continuously for the last twenty years. In 1949 catalog statistics were obtained by recording various processing steps on mark-sense cards. Between then and 1963 additional applications were added: 1950--financial records of periodical subscriptions and standing orders; 1955--ordering and accounting extended to one-time orders; 1958--circulation records; 1962--preparation of catalog cards. These applications are described in detail in the 1963 Clinic on Library Applications (2).

By 1963 the rate of acquisition had almost doubled and the volume of processing had increased to the point where the equipment was reaching the limit of utilization. It was then decided to consider installation of a small computer, which was actually acquired in 1966.

In 1964 circulation was converted to an IBM 357 system using a punched and printed book card and a punched and printed plastic ID card for the borrower. Both the use of the computer and the circulation system are described in more detail in Parker's article "Not a Shared System" (3).

Today individual applications are being incorporated into a master computer-controlled system. The acquisitions, bibliographic control, and circulation are becoming part of a single system to perform more tasks than heretofore.

A. Book Orders and All Other Documents relating to Book and Periodical Acquisition

Since the computer is used to prepare book orders and since all documents relating to book and periodical acquisitions are machine readable, the computer checks to see if an item is already on order and if there is sufficient money in the account before the purchase order is issued. The computer also keeps control of scheduled delivery, prints an expedite letter, and issues notification if an item is received without the invoice. This ordering routine does not include serials holdings records.

B. IBM 357 Data Collection System for Circulation

The IBM 357 Data Collection Units continue to be used for charging and discharging as described above. Circulation files are now stored on magnetic disks and borrower files on magnetic tape. It is possible to send overdue notices, to prepare lists of books on reserve by course and professor, and to perform other usual circulation control functions in a semi-automatic manner.

C. Preparation of Catalog Cards by Computer and Paper-tape Typewriter

For some years the Library had prepared many of its catalog cards from punched paper tape, using the Flexowriter. Since arrival of the computer, the procedures have been improved.

Each of the cards necessary to complete a catalog card set is formatted and stored temporarily on a disk. The records created for each batch are sorted by entry, and the resultant file is punched on paper tape. The paper tape is then read by Flexowriter to create the necessary catalog cards.

By making the card printing (typing, in this case, from punched paper tape) an offline operation, the Library is able to create cards with the upper/lower case, diacritical MARC character set without the disadvantages of slowing down the printer with a long and expensive print chain. (NOTE: Computer printers operate at 900-1200 lines per minute when using the limited character set that includes upper case letters only. As soon as a print chain is used with an expanded character set, i.e., upper/lower case, diacriticals, full punctuation, etc., the speed is reduced as much as one half and the cost increased proportionately.) Since the Library also serves the branch and subject division libraries, a fairly large number of sets for each title must be made. At the present time it is more economical to prepare the cards by this method than using the computer print chain.

D. Use of MARC Tapes

The Library was one of the sixteen original participants in the MARC Pilot Project. The first objective was to utilize the tapes to prepare catalog cards. As other libraries have done, the Library experimented in various ways with the tapes in anticipation of MARC II. Eventually the Library expects to use MARC data as a standard source of bibliographic data for all purposes, including ordering. An account of the Library's experience in the MARC Pilot Project appears in the Final Report (1).

E. Creation of a Government Document Index

This index, prepared on the computer, lists all U. S. documents by agency, title, and Superintendent of Documents Classification plus the call number if the document is cataloged. The index is prepared monthly with quarterly and annual cumulations and distributed to the units that need it.

F. Cooperation between the Library and the School of Library and Information Science

The School is working closely with the Library to expand the automated system. At present the School is undertaking a research and development program for the creation of a computer-based online bibliographic information system for use by all four campuses of the University.

IV. Future Plans

A. Acquisition of a Larger, Third-Generation Computer

This computer will provide online, real-time, remote access capabilities.

B. A Computer-stored Record for Books

C. A Computer-stored Record for Each Serial Title

The record for each serial title will include complete holdings, provision for check-in of individual issues, renewal notification, binding notification, claiming.

D. Online Circulation System

E. Participation in Regional and National Network Systems

V. Economics

Twenty years of experience with data processing equipment has proved the feasibility of its use in libraries, both economically and operationally. According to Parker's article (3), the University of Missouri's ordering and cataloging production per man-year with punched-card equipment was 1,400 volumes compared with the national average of 1,000 volumes. The Library spent 43 per cent of the budget on books, periodicals, and bindings and 48 per cent on salaries and wages. The national averages are 30 per cent and 65 per cent respectively. Since the computer is now being used, the ratio for the Library has improved to about 45 per cent and 45 per cent with 10 per cent miscellaneous. Even better percentages are expected when an online, real-time computer is installed.

VI. Sources of Data

1. Doell, Daniel W. "University of Missouri." In: The MARC Pilot Project. Final Report on a Project sponsored by the Council on Library Resources, Inc. Prepared by Henriette D. Avram. Washington: Library of Congress. 1968. p. 141-142.

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3. Parker, Ralph H. "Not a Shared System," Library Journal. XCII, November 1, 1967. p. 3967-3970.

4. Site Visit in January 1964. Interview with Dr. Ralph H. Parker, University Librarian.

Personal Communication with Dr. Parker, now Dean, School of Library and Information Science, 1969.

VETERANS ADMINISTRATION
LIBRARY SERVICE
WASHINGTON, D. C.

SUMMARY

The Veterans Administration operates a nationwide network of medical libraries under a single authority. The VA has a long-range plan for the application of ADP systems to its activities. The plan, called Total Information Processing System (TIPS), encompasses thirteen major subsystems of which scientific and technical information is one. The hospital library system is subsumed under the scientific and technical information subsystem.

Experimentation is going on in the creation of an automated data base in order to develop a methodology which will lead to a computer-based centralized catalog and resource control system. The team also expects to develop capabilities enabling the VA libraries to interface with other information subsystems and to identify methods for improving library service in response to expanding and changing requirements.

Ultimately the VA library is seen as the access point for all the library information resources required by the Agency, regardless of the format, source, physical location, or control of the resources. Each hospital library is conceptualized as a node in a strengthened national VA network with access not only to VA resources but to all other network resources in this country.

I. Background

Responsible for the administration of the nation's laws relating to veterans, VA is organized into three departments: (1) Medicine and Surgery (DM&S), (2) Veterans Benefits, and (3) Data Management (DDM). Within DM&S, to provide library services to patients, medical and paramedical staff, and employees, 368 full-time academically qualified librarians are employed in a nationwide network of 165 hospitals.

The Director, Library Service, is responsible to the Assistant Chief Medical Director for Professional Services for formulating and recommending policies, plans, and objectives for the library program in the Department of Medicine and Surgery.

VA Libraries have for many years had their own national network as well as a history of cooperation with other libraries in the areas in which they are located. Compared to the majority of hospital libraries, the VA Library collections tend to be better and the VA librarians better trained.

II. Objectives

The Veterans Administration has consolidated all efforts for the application of ADP systems to VA activities into a long-range plan. This plan, called Total Information Processing System (TIPS), encompasses thirteen major subsystems. One of the subsystems is scientific and technical information, and the hospital library system is a part of this subsystem.

Study of the library subsystem is being made by a team from Library Service, Supply Service, and Data Management Liaison of the Department of Medicine and Surgery and from the Department of Data Management--the latter is responsible for all computer operations. Objectives of the study are:

1. To develop a methodology which will lead to a computer-based centralized catalog and resource control system.

2. To develop capabilities which will enable the VA to interface with other information subsystems such as MARC and MEDLARS.

3. To identify methods for improving library service in response to expanding and changing requirements.

The hospital medical library in the VA is conceptualized as a center of information resources which are received, processed, and retrieved for use in the library, throughout the hospital, and among all hospitals in the VA network.

The VA library of the future is seen as the access point for all the library information resources required by the Agency, regardless of the format, source, physical location, or control of the resources. As a node in the national VA network, the hospital library will be a switching point for transfer of information among the components of the network as well as components of other networks.

III. Activities

Cataloging of books and the periodicals procurement service are handled by the Books and Periodicals Division, Somerville Supply Depot (New Jersey). The Book Cataloging experiment utilizes a computer at the Los Angeles Data Processing Center. At the present time data processing equipment is being used for several products. The periodical procurement cycle is based on printouts from punched cards, and the VA Union List of Medical Periodicals along with supplements is computer produced.

Study of the Library subsystem, which has been undertaken by a team from DM&S and DDM, is being done in two phases:

A. Phase I

Essentially fact finding, this phase was concerned with the identification and analyses of resource control and service functions with emphasis on acquisitions, cataloging, code standardization, storage and distribution demands against the library, and reports for library management.

B. Phase II

This phase is an experimental effort dealing with the storage and retrieval of information from an automated data base. The specific library functions involved are indexing and cataloging of books and the production of sets of catalog cards, book pockets, cards, and labels.

A computer data base is being developed from the most active portion of the master catalog file; approximately 20,000 records are being converted by keypunching, optical character recognition, and online cathode ray tube keyboard entry. Since book cataloging is already done centrally for the VA network of libraries, this provides a convenient point for the introduction of data into the system.

Procedures are being developed and tested for updating and maintaining the computer data base and for using this file to produce book catalog card service comparable to that furnished by the manual system.

In addition to providing traditional catalog service, the computer-based system will permit experimentation for other uses of the file to determine how the data can be exploited further; for example:

1. Better resource control through machine-produced information about the location, extent, and usage of library holdings.
2. Computer-produced recurring and specialized demand bibliographies as well as book catalogs.
3. Use of specialized terminals to improve searching.
4. Exchange with other computer-based systems.

   Outside interface relationships such as with the national libraries, affiliated medical schools, regional medical libraries, EDUCOM, and other available resources are being studied. Of particular interest are the methods of access. An experiment concerning interagency information exchange is being conducted using MARC II and MEDLARS data

A machine-readable data base could be used for centralized cataloging, basic and special book lists, review publications, book-format catalog to be revised periodically, and statistics for planning purposes.

The user of library services requires the library to provide a variety of mechanisms for the dissemination of information and data. These include the lending of items outside the library (circulation); reference services; bibliographic citations on a demand or recurring basis; selective dissemination of information against individual or group profiles; and information and data retrieval from files and data banks in the VA, other Government agencies, and organizations outside the Government.

IV. Future Plans

Use of a machine-readable data base can be extended to other areas such as: selection of materials, ordering and acquisition, fund and inventory control, file maintenance and updating, receiving and demand searches, and selective dissemination of information.

External forces affecting VA library service include involvement in the planning for regional medical complexes and for community health centers; continuing interest in the implementation of the Medical Library Assistance Act; and the Medical Sharing Act for training programs in cooperation with institutions of learning, medical centers, hospitals, and other appropriate agencies.

Plans for future VA library service have been developed within a realistic time frame:

1. Immediate future--feasibility studies and research in the application of data processing technology to the library information network.

2. In the early 1970's--introduction into the network of interim modules wherever they give promise of economy and efficiency.

3. Long range--an integrated system with local service nodes providing for immediate service requirements at the local level; backup provided by additional materials and referral or switching services at the regional level; and archival and specialized backup as well as switching to other national resources outside the VA at the Central facility.

Eventually equipment for direct access to the machine-stored data base will be provided in each hospital library. Also the medical library subsystem will be linked with the legal information subsystem and the medical research report subsystem within the VA.

Implementation of the VA subsystems plus continuing network developments will permit access data banks and a wealth of resources by each library in the VA system.

V. Sources of Data

1. Proceedings--Library Conference, March 28 and 29, 1968. Theme: Library Service--An Information Resource for the Patient and Medical Staff. Washington, D. C. 1968, 40p.

2. *Proceedings: Veterans Administration Conference of Selected Chief Librarians, November 14-15, 1968. Theme: VA Library Service--Interfaces and Projections for the Future.* Washington, D. C.: Veterans Administration, Assistant Chief Medical Director for Professional Services. 1968. 35p.

3. Veterans Administration. *Department of Medicine and Surgery Manual. Professional Services. Part Thirteen.* (M-2, Part XIII). Washington, D. C.: Medical and General Reference Library Staff. February 1, 1966. 1 vol. (various pagings).

4. Personal Communication with Mr. Henry J. Gartland, Director, Library Service, 1969.

WASHINGTON STATE LIBRARY
OLYMPIA, WASHINGTON

SUMMARY

Washington State Library was one of the first state libraries to use data processing equipment and the only state library among the original sixteen participants in the MARC Pilot Project of the Library of Congress. It produced an experimental book catalog of current acquisitions for three library systems, using the catalog information from the MARC tapes.

The Library continues to produce book catalogs for two regional library systems and to offer centralized cataloging services. In the future these services will be based on the MARC Distribution Services.

A most important objective of the Library is to develop a library network for the State of Washington. A plan has been prepared and is in the process of development. In the course of reaching the objectives of a statewide network, centralized cataloging services will be expanded and a pilot project will be conducted in preparing directories of holdings for network groups. Circulation control, a statewide union list of serial holdings, and a feasibility study of a statewide union catalog of non-book materials are in progress or planned as part of the network development efforts.

I. Background

Washington State Library is responsible for library service to the State Legislature and to State agencies on the one hand, and for the development of public library service and interlibrary cooperation in the State on the other.

As part of its public library service program, it has sponsored three multi-county public library demonstrations, for two of which a book catalog was developed. Both of these catalogs have been continued following establishment of the regional libraries as ongoing systems.

A. North Central Regional Library

The book catalog of the North Central Regional Library, with headquarters in Wenatchee, serves members of a five-county system. The original catalog was prepared from punched cards on an IBM accounting machine. The holdings of contracting libraries within the area were added in successive editions through 1962. Cumulative supplements cover additions from 1962. Production of the supplements was reprogrammed in 1966 for production by the State Library on an IBM 1401 computer.

B. Timberland Regional Library

The Timberland Library Demonstration began by compiling a union book catalog of member libraries in five counties in Western Washington. Cumulative, bimonthly supplements show additions to the collection since centralized processing was initiated in 1965. Catalog production by a combination of unit record equipment and computer processing is done by the State Library as part of its contract to provide continuing processing services.

C. King County Library System

A third book catalog in the State has the distinction of being the first machine-produced book catalog in the United States. One-line-per-title author, title, and subject catalogs have been produced for each branch of the King County Library System, serving the county outside of Seattle. Catalogs are reissued quarterly to reflect not only new titles but also the rotation of older titles among the forty branches.

II. Objectives

A most important objective of the Washington State Library is to develop a library network for the State of Washington, which can take its place in the national programs. A working paper for a library network plan was prepared by Joseph Becker and Robert M. Hayes in 1967 (1) in response to a request by the Advisory Council for Title III (LSCA). This concept of a network has been presented to and approved by the profession and by the public at a series of conferences early in 1968.

The plan is aimed at providing the means for more active sharing and exchanging of library resources in the State. Gradual introduction of electronic channels of communication among all libraries in the State will enable libraries to have ready access to one another's collections. Computer-produced catalogs, serving as union catalogs for a specified geographic area, will enable any individual to locate book material through his own library, even though the book itself may reside in a collection elsewhere in the State. The principal goal of the plan is to raise the level of library service in the State by strengthening local accessibility.

The library network plan uses the individual libraries in the State as its main building blocks. Around these libraries, the plan constructs a communications framework which links the individual libraries into twelve geographic areas. The dominant library in each area is designated as an Area Group Center. The Group Centers are connected to the Switching Center and through it to the major resource libraries in the State as well as to national resources. In addition to area affiliation, an individual library also may elect to associate with a Specialty Group. Such groupings may be formed as a result of requirements for service to specialized constituencies such as the medical community, the legal community, and so forth. Specialty Groups are also connected to the Switching Center.

Book catalogs for an Area Group are computer produced in standard format and arrangement by the State Processing Center. This Center is a state-operated organization for (1) ordering books for groups of libraries, (2) production and maintenance of book catalogs for their common use, and (3) physical preparation of the books if desired. The Switching Center refers requests from individual libraries to major state and national resources when requests for materials or information cannot be satisfied by Group Centers.

The recommended program plan is developed in five-year phases and is designed to articulate with emerging national programs to the maximum extent possible. Also taken into account are comparable efforts underway within the State. State Library participation in the MARC (Machine Readable Catalog) Project at the Library of Congress is a direct tie-in with a national effort.

III. Activities

A. Participation in the MARC Pilot Project

The Library was the only state library among the original sixteen participants in the MARC Pilot Project. It produced an experimental book catalog of current acquisitions of Timberland Library Demonstration, North Central Regional Library, and King County Library System, using the catalog information from the MARC tapes.

The experimental catalog consists of the following sections:

1. Register

   The Register contains the printout from the magnetic tape of a complete LC catalog card. Arrangement is by "register" or accession number, a unique number assigned automatically by the computer to each title in order of entry into the system.

2. Separate Author, Title, and Subject Indexes

   These are short finding-list type indexes serving either as an index to the Register volume of the catalog or for direct access to the collection. Each entry includes author, short title, publisher, date of publication, Dewey Decimal Classification number, and libraries owning the title, as well as juvenile or other special designations as required.

   In addition to the experimental book catalog, 3 x 5 catalog cards in sets or singles and labels for book cards, pockets, and spines were produced in batches by library. The 3 x 5 catalog card sets and single and multiple main entry cards are now regularly produced. A set of four labels (for book cards, pocket, and spine) is produced for each copy of a book in two of the three systems.

   Full details concerning the Library's participation in the MARC Pilot Project appear in the MARC Pilot Project Final Report (2).

B. Preparation of Book Catalogs

The Library continues to produce book catalogs for the North Central Regional and Timberland Regional Library systems. Production of these catalogs will become a part of future centralized cataloging services based on the MARC Distribution Services.

C. Management Services

Cost analysis of the centralized processing service is accomplished by computer, as is the production of mailing labels for State Library publications.

IV. Facilities for Automation--Hardware, Software, Personnel

The Library has access to computers at the State Data Processing Service Center. Input Preparation is done within the

Library and batch processed at the Service Center.

The Library has a staff systems analyst responsible for programming and may contract for additional programming services from the Center.

V. Future Plans

A. Directories of Holdings for Network Groups

Book catalogs, or directories, of the holdings of the libraries of each network area or specialty group will be begun as a pilot project covering current acquisitions of a group of libraries. Bibliographic data will be taken from MARC Distribution Service tapes. If expectations for the centralized conversion of retrospective records are fulfilled, the production of retrospective catalogs for network groups will be timed to take advantage of such a conversion effort.

B. Centralized Cataloging Services

Book catalogs, catalog cards, and labels will be produced for interested libraries from the MARC Distribution Service tapes and from local input in MARC II format. Ordering and in-process control will be integrated into the book catalog production program for the State Library and Timberland Regional Library. Expansion of ordering and physical processing services is not envisioned in the foreseeable future.

C. Circulation Control

Control of the rotation of materials among branches and of patron circulation control is planned for the State Library and eventually for the network system.

D. Serials

An interim union list of serial titles held within the State is in process, to be followed by a statewide union list of serial holdings. Automated acquisition of serials is planned for the State Library and its branches.

E. Non-Book Materials

A study is being made of the feasibility of a statewide union catalog of non-book materials and of a computerized film booking service.

VI. Sources of Data

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2. Pulsifer, Josephine S. "Washington State Library." In: The MARC Pilot Project. Final Report on a Project Sponsored by the Council on Library Resources, Inc. Prepared by Henriette D. Avram. Washington: Library of Congress. 1968. p. 149-165.

3. Site Visit in January 1968. Interviews with Mrs. Josephine S. Pulsifer, Chief of Technical Services, and Mrs. Jeannette Whitcher, Systems Analyst.

Personal Communication with Mrs. Pulsifer, 1969.

WASHINGTON STATE UNIVERSITY
HOLLAND LIBRARY
PULLMAN, WASHINGTON

SUMMARY

The Library of Washington State University has used data processing equipment in the Acquisitions Department since 1961. In 1966 with online, time-sharing facilities available on the Campus, the Library began work to design an online, time-sharing technical services system. Support was received from the National Science Foundation and International Business Machines Corporation.

To date an over-all system design for the entire Technical Services System has been completed. Most of the tasks for book processing in the Acquisitions subsystem are operational. Based on use of the single record created at the time of ordering, the Technical Services Subsystem will be created in increments--catalog card production, perhaps a partial book catalog, and cataloging.

Future plans include converting the present offline circulation subsystem to online access, developing a Serial Record Subsystem, experimenting with MARC tapes, and continuing research and development in information retrieval and communication processes.

I. Background

The Library collection is now over one million bound volumes housed in the central library and twenty departmental libraries serving about thirteen thousand students in nine colleges and the Graduate School and about fourteen hundred teaching and research faculty members.

The Library regularly receives over 9,000 journals, technical reports, and newspapers as well as some 500 periodicals on microfilm. It is also a depository for all major unclassified United States Government publications and provides specialized services for instructional research programs through the Audio-Visual Center, the Graphic Laboratory, and the Listening Laboratory.

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II. Objectives

A. Long-Range Objectives for the University Library

1. To provide complete information services for the University

    a. By developing an efficient automated system for acquiring, processing, and controlling the library resources.

    b. By evaluating, interpreting, and transmitting the intellectual content of the library resources.

    c. By identifying the optimal patterns of information flow and the relationships between man and the technology of information handling within the local environment and the national complex.

2. To coordinate its efforts in design, research, and development with other institutions, thus contributing to the emerging national and international plans.

B. Immediate Objectives

As a first step in the long-range program, the University identified four interdependent areas for study:

1. Automation of existing library operations with modification based on continuing experimentation and study.

2. Experimentation to determine the modifications of library procedures necessary to utilize computer hardware and software most efficiently.

3. Experimentation to identify patterns of information flow within the University and the Library's role as an agency of communication in teaching and research.

4. Research concerned with information systems, information identification and classification, and information transmission.

III. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

The Computer Center has an IBM 360/67 computer with a large online capability, the usual input/output devices, three 2311 Disk Drives, one 2314 Disk Cluster Drive, and one 2321 Data Cell.

The Library has four IBM 1050 typewriter terminals connected to the computer; each terminal also has a paper-tape reader and paper-tape punch for back-up and for other offline use. Two of the terminals are used for acquisitions and two for development.

Software presently used for Library operations are: Teleprocessing Executive Program to allow sharing by more than one separate subsystem; Library Executive System controlling all the programs that operate on the library data and data base (these programs are written in PL/1); WISBUM, an assembly language subprogram for teleprocessing terminal users.

B. Personnel

Since early 1966, the Library has had its own Systems staff responsible for all aspects of research and development in the use of data processing equipment.

IV. Activities

A. 1961-1965

1. Orders and vouchers prepared and appropriate records maintained on punched card equipment--1961.

2. Punched paper tape replaced punched cards to reduce costs and speed up the process--1963.

3. Books received from Richard Abel and Company on approval began to arrive with punched paper tape containing LC catalog card information. Entire catalog card sets were made from this tape by Flexowriter--1965.

4. Offline circulation subsystem--1965.

B. Since 1966

The availability of online, time-sharing facilities on the Campus influenced the decision to design and implement an online, time-sharing technical services system for the Library. Support was received from the National Science Foundation and International Business Machines Corporation. To date (February 1969) the following has been accomplished:

1. An over-all system design completed for the entire Technical Services System (all activities concerned with ordering and processing of materials before shelving). This over-all design provides for:

a. A common data base for all technical services functions.

b. Modularity within each function or subsystem, such as Acquisitions. The modular approach permits incremental implementation (automating additional tasks or segments based on what has been done before) and easy modification within a subsystem.

2. Detailed design and implementation of the Acquisitions Subsystem.

The Library decided to begin with Acquisitions since this is where all original data entries are made and also the area with the heaviest work load. After a detailed analysis was made of the work being done in Acquisitions, plans were laid for implementation. This subsystem, called LOLA (Library On-Line Acquisitions Sub-System), is described in a report by Burgess and Ames (2).

All bibliographic information known about a title is entered into the computer at the time the order is placed. As the book progresses through the various processes, the machine-stored record about the book is modified and incremented. When the Technical Services System becomes completely operational, all bibliographic data pertaining to a title will be completed in machine-readable form by the time the book reaches the shelf.

By using the status indicators for each operation, it is possible to have instant information regarding the status of books in process, either from printed lists or by addressing the computer file via a terminal. At present, status indicators are used in Acquisitions only.

After a trial run of six months, during which time many changes and refinements were made, actual production started in April 1968 and the following tasks for book processing are now operational:

a. Purchase Request Entry Preparation

After deciding to order a book, a search is made and all available bibliographic information is gathered preparatory to entering the order into the system.

b. Purchase Request Entry and Editing

At this point the data are entered via IBM 1050 terminal into the in-process file stored on a disk pack on a dedicated disk drive. Each field is tagged by the operator, and the computer checks and edits for valid entries.

A by-product is a book ID card to be used in the future with the IBM 357 badge card reader to monitor the progress of the book through the various processes. Eventually this card will become the book card for the circulation system.

c. Purchase Order Writing and Handling

Periodically the computer scans the in-process file to select titles ready to be ordered. For each of these titles an eight-copy purchase order is printed.

d. Book Receiving

Upon receipt of the book, the online file record is updated via terminal.

e. Invoice Handling

After verification of the invoice, the information is entered into the record via terminal.

f. SOAP (Standing Order on Approval Program)

From 40-50 per cent of the current acquisitions are acquired from one company through the SOAP program. If a book is accepted, the invoice information is entered through the terminal. Soon the standing orders file will be stored on the data cell rather than disks.

g. Receiving Report Preparation

This is the final step in Acquisitions and enables the staff to check invoices against the in-process file prior to payment by the Controller's Office.

h. Historical Information

As soon as processing is completed for a title, the record is transferred for storage on magnetic tape.

The current version of the Technical Services System allows for most basic operations. Modifications and refinements continue to be made, especially in the procedures; and additional features are planned.

Consideration is being given to the feasibility of continuing to input data by the online terminal versus punching paper tape offline and reading it into the computer. The operators prefer the online method, but it is considerably more economical in computer time and in cost to prepare data offline.

As soon as feasible, operational control of the Acquisitions subsystem will be transferred from the Systems staff to the Acquisitions staff. The two groups will continue to work closely in making changes and improvements.

V. Future Plans

A. Completion of Other Subsystems in the Technical Services System

The system is based on the single record now being created at the time of ordering. Increments will include cataloging, catalog card production, and possibly a partial book catalog. Ultimately the Library plans to replace the card catalog with an online computer-stored catalog.

B. Online Circulation Subsystem

The present offline operational circulation subsystem will be converted to online access within the next year.

C. Serials Record Subsystem

D. Preparation of Automated Book Card

When a book is first circulated, conversion will be made to an automated book card.

E. Use of MARC Tapes for Experimentation

F. Development of an Online Information Retrieval System

This is planned to begin in selected subject areas of the biological sciences.

G. Continuing Research in Information Systems and Communication Processes.

VI. Special Problems

A. Lack of assurance that the terminal system will operate for a guaranteed number of hours each day.

B. Excessive typographical errors in input.

VII. Sources of Data

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2. Burgess, Thomas K., and Ames, James L. LOLA--Library On-Line Acquisitions Sub-System. Pullman, Washington: Washington State University Library, Systems Division. July 1968. 74p. (PB 179 892) Distributed by the Clearinghouse for Federal Scientific and Technical Information.

3. Martin, Laurence David. A Model for File Structure Determination for Large On-Line Data Files. (Master of Science Thesis) Washington State University, Systems Division. 1968. 42p.

4. Personal Communication with Mr. Thomas K. Burgess, Manager, Systems Development, 1969.

YALE UNIVERSITY
LIBRARY
NEW HAVEN, CONNECTICUT

SUMMARY

The Yale University Library is the second largest academic library in the United States with a total collection of over five million volumes housed in the main library, Sterling Memorial, and more than sixty other locations throughout the Campus.

The automation activities are in two areas: Yale Bibliographic System (YBS) used in the Yale Medical Library and the Machine-Aided Technical Processing System (MATPS) used in the Sterling Memorial Library.

The main tasks of YBS are to store the catalog-card content in machine-readable form on magnetic tape and to produce catalog cards. As an original participant in the MARC Pilot Project, the Library has experimented with the MARC tapes and has implemented a limited number of functions related to the YBS System.

The main purpose of MATPS is to replace procedures in the Order Department and to monitor the processing of books from the time of request until they are shelved and ready for use. After the original order data are stored on magnetic tape, the record for each title is updated as the book progresses through the various processing steps. The "transaction" card used to update the computer record is prepared in the Library and is the product of a book process-control card, which travels with the book, put through a specially wired IBM 357 Data Collection Station to record the book's status as of any given time. There are six IBM 357 Stations placed throughout the various processing sections, each wired to record the completion of one or two processing tasks. Among the products resulting from the system is an in-process list which contains all items in process and a code indicating how far along each item is in processing. This list is issued weekly with daily supplements. Additional features of the monitoring capability are: notifying the appropriate section when a claim should be made and notifying the appropriate section when an item has been in one processing area too long.

I. Background

The Yale University Library has a total collection of over five million volumes, making it the second largest academic library in the United States. The main library, Sterling Memorial, has a collection of between three and four million volumes and the remainder are housed in over sixty other libraries throughout the Campus.

The total acquisition rate is about 75,000 titles a year. All processing is done in Sterling Memorial except for the Medical Library, the Law Library, Beinecke Rare Book and Manuscript Library, the Divinity Library, the Music Library, the Economic Growth Center, and the Cowles Foundation for Research in Economics.

Yale was one of the original sixteen participants in the MARC Pilot Project and experimented with the tapes as other libraries have done. Use of the MARC tapes is complicated by the fact that the MARC format does not conform to the machine-readable catalog format used at Yale. Also numerous classification systems are used in the various libraries of the University, resulting in additional compatibility problems.

II. Facilities for Automation--Hardware, Software, Personnel

A. Hardware and Software

The Computer Center has a large installation--IBM 7040-7094 direct coupled system plus an IBM 360/50 and an IBM 1401. Various peripheral devices include magnetic tape drives, magnetic disks, and upper/lower case printer. Since the Center operates 24 hours a day, most of the work for the Library is done on a regular schedule at night and over the weekend.

The Library has keypunches to punch input for catalog card production, and four IBM 826 Typewriter Card Punches and six IBM 357 Data Collection Stations for the technical processing system.

Principal software used for library processing is MAD (Michigan Algorithm Decoder). Since the MARC and Yale formats are not compatible, an interface called MATE (MARC Translate and Edit) enables MARC tapes to be used as direct input to YBS (Yale Bibliographic System).

B. Personnel

The organization of the Library includes several Associate Librarians, one of whom is in charge of the Office of Research and Development. This Office is divided into the Department of Research and the Department of Development. The work described here is mainly the responsibility of the Development Department, which has a staff of systems analysts and programmers.

III. Activities

The automation activities at Yale are in two areas: Bibliographic, known as Yale Bibliographic System or YBS; and the Machine-Aided Technical Processing System (MATPS). Both can be described as operational pilot systems. The accessions load is so heavy that the automated systems are not yet able to handle the total volume of work. Therefore, part is handled by automation and the remainder by the old manual system, but there is no duplication of work.

A. Yale Bibliographic System (YBS)

This system is used only in the Yale Medical Library. It is a computer-assisted catalog system that performs the functions of a master file maintenance on magnetic tape, 3 x 5 catalog card production, and periodic accessions list production (6). Thus, the catalog-card content is stored in machine-readable form on magnetic tape and catalog cards are produced regularly.

If the data appear on a MARC tape, the MARC Translate and Edit (MATE) interface program must first put the MARC record into the Yale input format. This reformatted input is then read into the computer the same as for original cataloging.

The MARC tapes have been used in other ways, and several functions have been implemented. In addition to using the MATE program mentioned previously, a New Titles Alerting Service for the Science Bibliographer and the Medical Librarian is being provided. Yale's use of the MARC tapes is described in more detail in the MARC Pilot Project Final Report (7).

B. Machine-Aided Technical Processing System (MATPS)

This system is used only to process materials through Sterling Memorial Library. At the present time almost all Roman alphabet acquisitions including Slavic materials that are Romanized are processed by MATPS.

Just recently the Development Department prepared a detailed manual containing system documentation of its MACHINE-AIDED TECHNICAL PROCESSING SYSTEM (4). The manual is for sale, and purchasers will receive updated information as it is prepared. Since the explanations are so explicit, several statements are quoted directly from the manual, including the following portion from the description and history:

> The Machine-Aided Technical Processing System at the Yale Library was designed to replace procedures in the Order Department, and to monitor the processing of books from the time of request until they are shelved and ready for use.

In 1965-66 a study was made of existing procedures in order to discover the underlying functional objectives of the department. Existing procedures were then evaluated to determine how well they met the listed objectives. It was felt that these objectives were not being adequately met and that a new system would be desirable. Operational goals of the new system were:

1. faster, more accurate processing of orders;
2. automatic follow-up and file weeding;
3. better communication with requesters;
4. control over all processes;
5. availability of current information about all books owned, ordered, and in process in the Library;
6. production of accurate, current statistics; and
7. production of management information to direct the system.

The system is designed to handle unitary procurement; extended procurement such as standing orders, blanket orders, and subscriptions; and gifts. Actual implementation began with unitary procurement or single titles.

The actual processing of orders consists of a combination of hand and machine processing, using the computer and other related data processing equipment. In addition, the computer monitors the progress of items through the processing sections from the beginning of the order until it is shelved.

The purchase order is prepared in the Library on an IBM 826 Typewriter Card Punch which types the order form and at the same time produces a decklet of punched cards for each title. The decklets are then sent to the Computer Center to be stored on magnetic tape. Decklets of cards are processed daily, and the computer issues two process-control cards for each title--a book process-control card which travels with the received book through the various processing steps, and an invoice process-control card which updates the machine-stored encumbered amount with the exact amount when the invoice arrives.

Six IBM 357 Data Collection Stations are located throughout the various processing sections to assist in monitoring the progress of items until they are ready for use. Each 357 Station is specially wired to record action of a normal operation.

For example, if the purchase order for a book is sent to the vendor, the process-control card for that book is inserted in the proper 357 Station; this action produces a "transaction" punched card identifying the title and the status (in this case, an outstanding order). The "transaction" card is later read into the computer to update the record on magnetic tape. When the book is received, the process-control card is inserted in another 357 Station to produce a "transaction" card indicating receipt. Subsequently, it too is read into the computer to further update the same record on magnetic tape. Provision is made in the system to handle many possible exceptions as well as the normal flow of work.

Transaction cards from all stations are accumulated throughout the day and sent to the Computer Center where they are batch processed to update all records on which there was some action during the day.

The monitoring capability includes notifying the appropriate processing section when a claim should be made to a vendor or when an item has been in a particular department or processing area too long. These two features alone have been worth a great deal by eliminating an excessive backlog of orders and by reducing bottlenecks. Graphs, statistics, and other data are supplied management; management in turn evaluates the data and sends directives to the processing sections.

By the combination of process flow which handles the procedures within the Library and process control which monitors the procedures, machines have taken over many of the laborious tasks formerly performed by hand.

Data are processed in batches on the computer each day. New titles are added from the decklets of punched cards; existing records are updated to indicate change in status or actual price as recorded by the appropriate transaction card. Transaction cards were made when the book process-control card or the invoice process-control card were put through the proper 357 Station.

The system supplies products which are of use not only to the Library but also to the patrons. Printed lists enable a requester to check for himself the status of books he has requested without having to ask a librarian. Processing sections can monitor their own activities and adjust their schedules and priorities accordingly without a great deal of extra effort; management can base its decisions on factual information rather than suppositions; and the flow of materials from one section to another has become smoother and more coordinated.

Examples of the products supplied by process control are:

1. In-process lists issued weekly with daily supplements containing all items in process; one list is by author, and another list by order number;
2. Weekly registers of fund commitments and expenditures, requesters, and dealers;
3. Letters to requesters reporting the status of their requests;
4. Memos to dealers and staff members of action which should be taken;
5. Graphs and statistical reports issued periodically and on demand.

IV. Addenda

A. The Library will not include Serials until an online system is available; instant access to the computer is necessary to record arrivals in a library of this size.

B. The Department prefers to use punched cards rather than punched paper tape as input--easier to handle and easier to correct, thus making it faster. Also the computers at the Yale Computer Center do not accept paper tape as input.

C. For the most part relations with the Yale Computer Center have been satisfactory, but it was necessary to have some serious discussions with the staff regarding schedules.

D. Eventually "upper management" will be given weekly reports in graph form (prepared on the computer) to show the status of all work. From these reports they can spot bottlenecks, add to or subtract from the staff, adjust schedules, acquire new equipment, etc.

E. The Research Department of the Office of Research and Development is engaged in various projects including a two-year study to determine user requirements of a large university library catalog for use in planning catalog automation (3, 8). This is part of the Library's long-range program for research on library problems.

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Personal Communication with Mr. Weisbrod, 1969.

C. Activities in Other Libraries*

In addition to the libraries summarized in Section IV.B., there are many others involved in automation. Some have used data processing equipment for many years while for others it is a relatively new experience.

Listed below are a number of libraries that have reported within the last two years. No attempt was made to check their progress, and the list is not meant to be complete. It does, however, give a representative cross section of what is taking place. References for other libraries appear in the LOCATE and ERIC Bibliographies.

1. Academic Libraries

a. Brown University Library, Providence, Rhode Island: Library fund accounting; computer based, operational (47).

b. Columbia University Libraries, New York City: Announcement: circulation in General Library--operational; major reserve book operations and acquisitions--in progress; two computerized scientific data banks--operational; intensive study of library operations and development of new systems; all operations computer based (28).

c. Hampshire College Library and Transfer Center, Amherst, Massachusetts: A new concept for the library in a new college scheduled to be opened in 1970-71 (44,45).

d. John Hopkins University Milton S. Eisenhower Library, Baltimore, Maryland: Acquisitions, cataloging, shelf list, circulation; computer based; partially operational (21).

e. Lorain County Community College Library, Lorain, Ohio: Integrated acquisitions and catalog files; computer based; operational (40).

f. Midwestern University Moffett Library, Wichita Falls, Texas: Circulation; shared-time, online, computer based; operational (20).

g. Oakland University Kresge Library, Rochester, Michigan: Book order and circulation control; computer based; operational (4).

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* References for Section IV. C. appear at the end of Section IV. C.

h. Purdue University Libraries, Lafayette, Indiana: Development of a comprehensive system; computer based; partially operational (19).

i. Standord University Libraries, Stanford, California: Book catalog for undergraduate library, shared cataloging, Project BALLOTS (bibliographic automation of large library operations using a time-sharing system); computer based; operational (9,22,41).

j. State University of New York, Buffalo, Libraries, Buffalo, New York: Machine-readable bibliographic data, circulation; real-time, online, computer based; operational (5,27).

k. Texas A & I University Library, Kingsville, Texas: Acquisitions, circulation, serials; computer based; operational (30).

l. University of Chicago Libraries, Chicago, Illinois: Integrated bibliographical data system, reference retrieval; computer based; partially operational (16,35,48).

2. Academic-Special Libraries (Special libraries with academic affiliations)

a. Johns Hopkins University, Applied Physics Laboratory, Silver Spring, Maryland: Master book file, circulation; computer based; operational (8).

b. University of California, Lawrence Radiation Laboratory Library, Livermore, California: Acquisitions, cataloging, circulation; computer based; operational (12)

c. University of Louisville Kornhauser Health Sciences Library, Louisville, Kentucky: Serials control, interlibrary loans, circulation of books and serials, acquisitions; computer based; operational (2,3).

d. University of Minnesota Biomedical Library, Minneapolis, Minnesota: Serials; computer based; operational (17).

e. Washington University School of Medicine Library, St. Louis, Missouri: Since 1963 this Library has regularly and conscienciously reported its progress for serials, book catalogs, circulation, acquisitions, cataloging, SDI; computer based; operational (6,10,11,13,29,33,36,37,38,39).

3. Public Libraries

a. Illinois State Library, Springfield, Illinois: Circulation; online, computer based; operational (18).

b. Orange County Public Library, Orange, California: Acquisitions, bibliographic control; computer based; operational (25,26).

c. San Francisco Public Library, San Francisco, California: Serials control; computer based; operational (15).

4. Special Libraries

a. B. F. Goodrich Research Center Library, Brecksville, Ohio: Circulation control, book catalogs, journal files, information retrieval (thesaurus, dual dictionary, bibliography); computer based; operational (14).

b. Bell Telephone Laboratories Library, Murray Hill, New Jersey: Circulation control; real-time, online, computer based; operational (7,23).

c. Deere & Company Library, Moline, Illinois: Serials check in and routing--operational; acquisitions, cataloging, indexing, SDI--under development; computer based (1).

d. Fort Detrick Technical Library, Maryland: Serials control; computer based; operational (49).

e. IBM Electronics Systems Center Library, Owego, New York: Circulation control; computer based; operational (42).

f. Lockheed Missiles & Space Company Technical Information Center, Palo Alto, California: Microfilm catalogs, circulation control; computer based; operational (24,32).

g. Philip Morris, Incorporated Library, Richmond, Virginia: Catalog cards, bulletin; computer based; operational (31).

h. Radio Free Europe Library, New York City: Serials control; unit record equipment; operational (43).

i. RAND Corporation Library, Santa Monica, California: Authority lists; computer based; operational (46).

j. Sandia Corporation Library, Livermore, California: Acquisitions, cataloging, book catalogs, circulation, SDI; computer based; operational (34).

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D. Cooperative Projects*

Cooperation among libraries is not new, but its greatest growth has come within the last ten years. For many of the same reasons that libraries are using data processing equipment, they are finding it expedient to join together. They become members of centralized processing centers to relieve the pressures in technical processing. They expand their interlibrary loan agreements, connect with other libraries by teletypewriter, and become members of a group or network to share resources and to gain access to other collections in order to improve their reference services.

Librarians recognize that cooperation in any form makes certain demands, requires regulations, and carries with it some implications. These fundamental considerations are discussed in Section V.J.

Listed below are a number of cooperative projects, most of which have reported within the last several years. No attempt was made to check how far their plans have progressed beyond what was last reported, but the value of these reports for other libraries lies as much in the recommendations as in the actual accomplishments. One must bear in mind that the time lapse between initial consideration and even partial implementation of a cooperative project may be as much as five years or longer, and usually the larger the system under development the longer it takes. These projects are at different stages of design and development; and as far as is known, each involves the use of computers. Other examples appear in the LOCATE and ERIC Bibliographies and all volumes of the Annual Review.

1. Academic Libraries

a. Claremont Colleges, Claremont, California

This is a cluster group of six private colleges sharing a single library system and centralized processing and computer center. Automated techniques have been used since 1966 and include ordering, bookkeeping, book lists, and book catalogs. Teare reports on their experience to date in acquisitions (27).

b. Five Associated University Libraries (F. A. U. L.), Syracuse, New York

F. A. U. L. is comprised of five university libraries in New York State--Cornell University, SUNY/Binghamton, SUNY/Buffalo, Syracuse University, and University of Rochester. This system is under development and some phases are still under study. The F. A. U. L. MARC Processing Center converts tapes to a modified MARC II format; a merged file of cataloging records of the institutions is now being prepared; circulation systems are under study; and numerous other projects are in various stages of development. Periodically the F. A. U. L. Newsletter is issued to keep members and other interested parties informed of associated activities (8).

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* References for Section IV.D. appear at the end of Section IV.D.

c. Ohio College Library Center, Columbus, Ohio

Membership in the Center now includes 50 public and private Ohio colleges and universities. Just being developed, the Center is in the process of gathering the bibliographic records of the members for a central union catalog. The principal academic objective is to increase availability of library resources for use in educational and research programs of Ohio's academic institutions (23). The principal economic goal is to lower the rate of rise of per-student library costs. Five major subsystems have been designed:

(1) A shared cataloging system based on a central computerized catalog (this will be the first to be implemented).

(2) A remote catalog access and circulation control system for student and faculty use.

(3) A bibliographic information retrieval project.

(4) A serials control system.

(5) A major technical processing system.

d. Universities of Metropolitan Washington, D. C.

The Consortium of Universities of Metropolitan Washington consists of five privately controlled universities in Washington, D. C.--American University, Catholic University of America, George Washington University, Georgetown University, and Howard University. Already engaged in cooperation by sharing resources and coordinating their collection building, the Consortium was interested in knowing whether a joint computer center would fill the automation needs of each library better than the computer centers of each institution.

A feasibility study was made by Parker, resulting in a final report, A Feasibility Study for a Joint Computer Center for Five Washington, D. C. University Libraries (24). Such a computer center is determined to be feasible and four alternatives are proposed to meet the objectives. The first involving considerable independent action by each library is not recommended. The third, a sophisticated online system, and the fourth, a sophisticated online system plus a central facility for little used material, are not recommended immediately but could follow from natural growth and improved economics.

The second alternative, a jointly operated small- to medium-sized computer operated in batch mode with basic records stored on magnetic tapes, is recommended for implementation as soon as possible. Because of legal restrictions, the joint computer facility will have to be independent of the institutions.

If the recommendations are adopted, this facility will provide complete central processing including ordering and cataloging. In the beginning old records will probably not be converted, but conversion could be scheduled as proved desirable by experience. Catalogs of each institution will remain on cards, but new records will be created on cards by computer and also stored on magnetic tapes. These machine-stored records will be used for the creation of book-form supplements to serve as a vehicle for making the combined resources available to all users. Estimated costs are included in the study.

2. Academic-Special Libraries

There are many cooperative projects throughout the country in the biomedical or health sciences field. Most seem to be limited to TWX or standard interlibrary loan arrangements. According to the literature the SUNY Biomedical Communication Network appears to be the most advanced in the use of computer technology.

a. SUNY (State University of New York) Biomedical Communication Network, Syracuse, New York

Although used for biomedical information, this system was designed as a university-wide prototype to be as widely compatible as possible with other systems.

The Network was conceived in 1965 and began operation in 1968, and there are now ten participating medical and health sciences libraries--four SUNY medical libraries, University of Rochester, Albany Medical College, Countway Library of Harvard University, Parkinson's Disease Information Center at Columbia University, New York State Medical Library, and the National Library of Medicine.

The headquarters are located at the SUNY Upstate Medical Center Library in Syracuse, and each participating library is linked by one or more typewriter-style terminals to a large computer installation in Syracuse.

The Network functions are controlled by SYMBIOSIS (System for Medical and Biological Sciences Information Searching). This is an online, real-time, system primarily oriented to the user and secondarily to the library housekeeping routines. Primary services include computerized union catalogs and lists of monographs and serials; searches of catalogs and MEDLARS data; SDI services; KWIC indexes; recurring bibliographies; and currently reviewed books and serials. Secondary services include ordering, circulation control, serials control, and other services as desired by each campus.

The MARC format has been adopted. MeSH terms are used for medical books and LC subject headings for nonmedical books, from which a unified authority list has been prepared. A unified name authority list has also been produced.

A significant experiment undertaken in SYMBIOSIS is the depth indexing of monographic literature. The experiment is based on the hypothesis that the reason medical books are not used more is because the contents are less accessible than journal literature. Books have been analyzed chapter by chapter, and an average of seven subject headings given to each chapter so that books now have thirty-forty or more subject headings instead of the usual two or three.

The system offers flexibility, versatility, and compatibility. Its primary obligation is to serve all users within the system quickly and easily according to their needs for information. A more detailed description of the system is given in Pizer's "A Regional Medical Library Network" (25).

3. National Libraries

a. National Library of Medicine

As a result of the Medical Library Assistance Act of 1965, the National Library of Medicine is administering a large program in biomedical communication. The specific program objectives, according to Wilson (29), are as follows: provide financial assistance for improving biomedical libraries; encourage and assist the establishment and functioning of a national biomedical information network by strengthening present biomedical libraries and their interlibrary relationships; and assure that the biomedical library network is linked to related science information systems. The ultimate goal is to develop the library as a full learning resource center for education, research, and service. The regional library program aims to augment the capability of existing medical libraries so that information is more readily available.

The National Library of Medicine and the MEDLARS (Medical Literature Analysis and Retrieval System) Search Centers throughout the country provide bibliographic information as a result of running searches against the bibliographic holdings in the computer files of the National Library of Medicine. Some searches are run on the computers at the MEDLARS Search Centers and others at NLM.

The Library is also responsible for developing a system of Regional Medical Libraries to provide backstopping interlibrary loan service and also to provide access to MEDLARS services for the region. This program is explained in an article by Douglass describing the responsibilities of regional libraries (6). The Countway Library, Boston, was the nation's first Regional Medical Library and began in October 1967. Their first year's experience as a Regional Library appears in an article by Colby. "NERMLS: The First Year" (4).

The Biomedical Communications Network is now being planned and will be made up of several components including the library which provides services in the form of bibliographic references (MEDLARS) or actual delivery of documents. These plans are described in "The Biomedical Communications Network" by McCarn (12).

b. U. S. National Libraries Task Force

In 1967 the three national libraries (Library of Congress, National Library of Medicine, and National Agricultural Library) formed the U. S. National Libraries Task Force on Automation and Other Cooperative Services. Its broad purpose is "to improve access to the world's literature in all areas of human concern and scholarship, so that comprehensive access to the materials of learning can be afforded to all citizens of the United States"--a quotation from an article by Lazarow (11). The specific goals stated are the development of a national data bank of machine-readable cataloging information and a national data bank of machine-readable information relating to the location of hundreds of thousands of serial titles held by American research libraries.

Within this Task Force there are ten working groups, each concentrating on a specific problem area: acquisitions, bibliographic codes, character sets, descriptive cataloging, output, machine-readable format, name entry and authority file, serials data program, subject headings, and systems. They have adopted a standard communications format for machine-readable data and have agreed on standards for descriptive cataloging. Data prepared by all three libraries are now available on the MARC tapes.

4. Public Libraries --

Public libraries throughout the nation are cooperating in different ways. Some projects are at the area or multi-county level, but much of it is initiated, promoted, and sponsored by state libraries. Several examples are given below:

a. California State Library, Sacramento, California

The State of California has many area or multi-county cooperative projects throughout the state. In addition, the State Library has had extensive studies made for the design of a technical processing center to provide computer processing services to libraries throughout California (details are given in the summary for University of California, Institute of Library Research, in Section IV.B).

b. Illinois State Library, Springfield, Illinois

After an extensive study of the processing needs of the public libraries of Illinois, the following conclusions were reached: (1) One centralized processing center is feasible for the public libraries and library systems of Illinois; and (2) An electronic data processing and communication system, with terminals at the centralized processing center and the State Library, should be utilized to retrieve cataloging and processing data generated and stored in the computer facilities at the Illinois State Library. Details of the study appear in Highum's report, Centralized Processing for Public Libraries in Illinois (10).

c. Maryland Public Libraries in Four-County Area--
Anne Arundel, Baltimore, Montgomery, and
Prince George Counties

Since 1966 four suburban counties in the State of Maryland have been exploring the possibility of establishing a computerized library service center to handle order procedures, cataloging and processing. Three of the systems are already using data processing equipment; and one, Prince Georges County, has a machine-readable data base. The plan calls for a single machine-readable data base, derived from the MARC tapes, from which four quite different book catalogs will be made. Details of the plan appear in a report by Duchac, A Library Service Center for Suburban Maryland County Library Systems (7).

d. Nassau Library System Service Center, Nassau County, Garden City, Long Island

The Nassau Library System Service Center is an association of 53 independent public library systems in Nassau County. Membership is voluntary, and libraries belong to the System under contract, renewable each year. Each library is free to accept or ignore any of the services provided by the Center.

As one of the largest public library agencies in the country, the Center is organized in such a way that the Center staff has little control over its members and allows each member a great deal of freedom. This functional democracy existing in the System has caused conflicts and problems which must be taken into account in an organizational structure of this type. An article by Nyren, "A New Breed of Cat" (22) reports on a visit to the Center and reflects on its problems and the forces at work in a fast-developing system of this type. In spite of the troubles the Center is having, he considers it a new type of agency with "raw, exciting promise."

e. New York State Library, Albany, New York

New York State Library has one of the longest histories and one of the most extensive programs for public library cooperation of any state. Many reports have been issued in connection with the program, a few of which are mentioned here.

(1) Centralized processing for the public libraries of New York State--ANYLTS (Association of New York Libraries for Technical Services)

The public libraries began organizing into 22 systems in the late '40's. By 1968 all but a few of the public libraries were in one of the systems which offer a variety of services including the processing of library materials. An extensive survey was made by Nelson Associates, Inc. (13) to find out the optimum number of processing centers required and the best method for developing catalogs for member libraries.

The recommendations were: (a) one state-wide center for cataloging and acquisitions for all public libraries, and six centers for physical processing--three for upstate needs and three already existing (New York Public, Brooklyn Public, and Queens Borough Public); (b) a union book-form catalog for six or seven of the largest libraries in the State, nine regional book-form catalogs for about 180 of the next largest; (c) computers to be used extensively. In 1967 a pilot project was recommended, the objectives and requirements of which are detailed in an extensive report (14). About the same time a two-volume report was published on a proposed computer system for centralized book acquisition (26).

At the time the first study was made, a concurrent study (15) examined the question whether a centralized system should offer services to private and public schools and colleges, except the public schools of New York City. Most were interested, but a preference for centralization by type of library was expressed more strongly by college than school libraries. Eventual inclusion of these libraries has not been ruled out, but they are not to be included at the outset.

(2) Reference Services

The State Library has been very active in the field of reference, and numerous reports have been generated as a result of these activities. The 3R's program (reference and research resources) began in the early '60's to survey the reference and research resources of the State, to define the role of special libraries in the program, and to foster increased service to advanced scholars and researchers, and to business and industry through a network. Nelson Associates made studies in 1963 (16), and A. D. Little, Inc. made a study in 1967 (1) in connection with the 3R's program. Although the program has had problems, it has broadened the horizons of many regarding cooperation.

As part of the 3R's program, a statewide interlibrary loan project, NYSILL, began in March 1967, and a facsimile transmission experiment in 1968. NYSILL links the State Library with three large public and nine private research libraries to provide statewide access to their collections via interlibrary loan. The project was plagued by slow delivery, high costs, and other inconveniences; but new guidelines were established. Reports by Nelson Associates (17,18) as well as a summary in Bookmark (19) and in Library Journal (21) describe the program. The facsimile experiment ended March 31, 1968, because of poor performance, high costs, and insufficient demand (20).

Other projects are going on throughout the State. An evaluation of the public library systems from 1963-66 included many recommendations and suggestions for future consideration (28). The need for more coordination of all types and at all levels and the need for public libraries to improve information services are strongly recommended.

f. Southern California Libraries in Four Counties--Los Angeles, Orange, Riverside, San Bernardino

These four counties are experiencing the greatest numerical increase in population of any area in the country and now outrank all fifty states except California itself and New York State. The soaring population is making demands for library services which libraries are unable to meet. Although the area is rich in library resources, the need to make these resources available to more people has been apparent for some time.

The result of an extensive survey of the library resources and needs in the area were published in a report, Strength Through Cooperation in Southern California Libraries (3). Although the survey was made some years ago, the techniques used to gather the data and arrive at conclusions and recommendations are thought to be of value to other libraries. Since public libraries in the area initiated the survey, they were studied in depth; but special, academic, and school libraries, studied to a lesser extent, were also included in the recommendations.

The recommendations, detailed and comprehensive, include the following: (1) a cooperative library system for the public libraries of the four counties; (2) cooperative arrangements with university, college, public school, and special libraries of the area; (3) adoption of three levels of service--community, area, and research; (4) development of 12 area libraries and a bibliographical center; (5) appropriation of money for a study of the use of data processing equipment and of new technology in future library operations; (6) establishment of a single automated processing center.

The report lists priorities for service and gives strong arguments for strengthening both the resources and the services of libraries in the four-county area. Recommendations are made for setting up a formal mechanism to provide centralized cataloging and processing services to the public libraries and for sharing the resources of all libraries in the area that are willing to cooperate.

g. Texas State Library

For some years the Texas State Library has used data processing equipment in its Centralized Processing Center. In addition, the Library has co-sponsored conferences for future development. The First Texas Conference on Library Mechanization held in 1966 was an introduction for many librarians to library mechanization and the work going on throughout the State (5).

5. Special Libraries

a. IBM Corporation, Systems Development Division, Poughkeepsie, New York

This library provides book acquisition and processing services to IBM Libraries in Boulder, Colorado; Burlington, Vermont; and Kingston, New York. The system uses a computer located in Poughkeepsie operating with Administrative Terminal System programs for online processing and communications among libraries. An article by Bateman and Farris describes the details of operation (2).

b. Medical Library Center of New York, New York City

The Medical Library Center of New York, incorporated in 1959, is a bibliographical center to serve the medical institutions of Metropolitan New York. Its purposes are to provide a central book storage facility for such publications as may readily be shared, and to house and supervise the operation of the Union Catalog of Medical Periodicals, an up-to-date listing of periodical literature available in the New York Area (9).

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SECTION V - FUNDAMENTAL CONSIDERATIONS*

Earlier sections of this report traced the development of automation in libraries and summarized what is actually taking place in a number of libraries throughout the country.

This section is concerned with the basic elements that constitute an automated system. Within each element there are circumstances to be considered, choices to be made, problems to be solved, and decisions to be reached that affect the course of automation within the library. These are called "Fundamental Considerations."

In the beginning automation was introduced to solve some of the problems in libraries and has become increasingly successful in finding solutions. Nevertheless, the use of data processing equipment is a complex undertaking and for most libraries it is still a new experience. Like all new endeavors that cause change, automation has introduced a new set of requisites and some inherent problems. These requisites and problems are fundamental considerations that cannot be disregarded.

References cited throughout this section represent only a small part of the total literature that is relevant. These citations include those published in 1969 and selected references from previous years. Additional references appear in the LOCATE Bibliography covering the literature through early 1967 (96); the ERIC Bibliography covering the remainder of 1967 and 1968 (95); and all volumes of the Annual Review, which have chapters on library automation and related topics, each with an extensive reference list (31, 32, 33).

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* References for Section V appear at the end of Section V.

A. The Library Patron and His Needs

All libraries are committed to giving good service so the first and fundamental consideration of the library, regardless of the methods used for internal operations, must be the patron. The patron is the target and the library is his host; on this point presumably all librarians agree. And yet one can easily get the impression from reading the literature that the patron (or reader or user), call him what you wish, is in the process of being newly discovered. This new evidence of concern is caused by a number of factors.

One is the fact that the libraries are making an effort to reach groups who do not now use libraries and to improve services to their regular patrons. They are well aware that not all libraries convey their dedication for service to the public and that the library is a forbidding institution to many people--too many. The library as an institution is in a state of transition, and these efforts to reach a larger segment of the population and to offer expanded services to present users are part of the "changing role." While retaining its custodial responsibilities, the library is searching for new ways to become a more aggressive agent of information resources. Some libraries have obviously gone much further than others in this direction.

A second reason, closely related to the first, can be attributed to automation. Automation provides the capabilities for much more intensive and extensive service. Furthermore, it emphasizes the importance, in fact the necessity, for designing a system based on the main objective--the patron and his needs. As libraries become increasingly able to offer expanded services, further study needs to be given to the kinds of services to offer. If we know too little about the user of today, we know even less about the user of tomorrow, for he too is sure to change his habits to take advantage of technological advances.

Even though the theory has not been tested, it may be assumed that every librarian has been "dreaming" of the day when he can offer to his patrons the total resources of all libraries conveniently and easily. There has never been a need to test this assumption before, because even the paragons of the profession could not have provided such service. Librarians have probably given the best service they could with the resources available to them, although sometimes it has been quite limited. Today, however, the picture is changing and these "dreams" are in the process of being realized. Today it is technologically possible for any library anywhere in this country to be linked to all other resources within the country. What librarians will eventually be able to accomplish in sharing resources and in developing successful networks will be a real test of their resourcefulness, dedication, and sincerity in attempting to provide super service to all patrons. With a total network system, it is conceivable, theoretically at least, that whatever service or information is requested in any library can be obtained from some place and within a relatively short time.

The possibility of offering such service is receiving increasing attention. In a series of articles reporting on a project for developing methodologic tools for planning and managing library services, Orr, et al., state that the user should have a "primary" library, and the librarian's sole responsibility should be to make it possible for the clientele to tap the total store of recorded information effectively and efficiently within practical constraints (170). This carries the implication of cooperation with other libraries and information centers and assumes relatively easy access to other collections.

In November 1967, System Development Corporation released a report, Technology and Libraries (34), one of seventeen library-related reports prepared by different organizations for the National Advisory Commission on Libraries. The report noted that the purpose and general character of library services have not changed over the past forty years. What has changed is the range and volume of demand and use. Specializations in new subject areas have emerged, and the user population is larger, more literate, and more demanding (34, p.18).

Some libraries have already undertaken programs of improvement, including the use of data processing equipment to relieve the burdens imposed by increased demands; and others will certainly follow. The report states, however, that these programs of improvement at their present level will do little more than keep pace with present levels of service. To do more than just keep pace, i.e., provide better and broader services, a more aggressive and integrated approach will be needed. Libraries must think in terms of more interdependent modes of operation and will have to exploit the technology to better advantage for a nationwide improvement in library services, the principal interest of the Commission (34, p. 26).

The report further points out that, although it is understandable for libraries to concentrate on their own pressing problems and internal operations, the greatest potentials of technology may have to do with functions and services not now commonly performed in most libraries (34, p. 62).

Of necessity, today's libraries tend to cater to groups, e.g., public, academic, special subject areas, adults, children, students, etc. The patron has become accustomed to seek certain types of information in certain types of libraries. If his needs are different from those he expects any given library can handle, he uses alternative sources. Thus, a library is able to judge its success by how well it satisfies the requests made, but it is not able to determine the number of requests not made because the user did not expect the document or information to be available. Furthermore, the majority of today's users are not accustomed to instant information or materials if the source is located elsewhere. They are prepared to wait days, weeks, and even months. Several experimental projects in facsimile transmission (discussed in more detail in Section V), whereby full text is transmitted by telecommunication, give some clues as to present response to fast service. The service was much faster than the patrons were accustomed to receiving. In the experiments, patrons were often lax in picking up the materials after the library had obtained them in a matter of hours.

It is certain that the library patron of the future will not be content with the level of service that libraries are now able to offer. His needs and expectations will grow as the means become available to satisfy them. Today we must treat each user as an individual member within a group, even though we know there are many kinds of users and each user at different times has different kinds of needs. Computer technology offers the potential to custom tailor each request for library service to the user's need at any given time.

At the present time the closest any library comes to providing custom service is with SDI (Selective Dissemination of Information), which bases the selection of materials for an individual on his "profile." Although SDI gives each individual a bibliography tailored to his interests, the contents are usually limited to the library's holdings; and in most cases it is the user's responsibility to obtain the document. A few SDI systems, such as exist in some special libraries, do provide the document on short notice, but this is not a common library service.

The possibility of having machine-readable data available to any library patron via a remote-access terminal and of having documents readily available from other libraries by facsimile transmission or in microform can be foreseen for some types of libraries before it is for others. Special libraries, especially those involved in the physical sciences and engineering, and special libraries in an academic environment, such as those in the health sciences, already have a sizable body of machine-readable information of different kinds available. Furthermore, these libraries are more accustomed to providing personalized services of different kinds, and their users are often more adaptable to change and more familiar with technological developments.

However, regardless of the type of library, the system should be designed with a flexibility which can serve the user in the way most satisfactory to him. While automation in most cases has been conceived as a means for increasing the productivity of the library and its staff, no system can really be justified unless it can prove in some way, directly or indirectly, that it has helped the patrons. For example, as a result of the system's performance, the library may be able to offer faster service, or save the users' time and effort, or provide easier access to materials, or offer an expanded collection with more depth and/or wider coverage, or give more personalized service, or shorten the time from acquisitions to shelving. Any one of these offers something better than before.

Just as systems designers have encountered resistance from librarians, so may they be expected to encounter resistance from patrons. Patrons, too, are creatures of habit and will have to be "sold" on the merits of any new method which affects their regular practices. Some believe that there would be considerable resistance today by many patrons if they had to use remote-access terminals to query a machine-readable catalog file. Unless the user is familiar with the capabilities of the equipment, he may consider this approach too difficult and time consuming. If a system makes any search for information more difficult or less attractive than it was when using the existing methods, the system is poorly designed. A system designed to serve the patron must be sufficiently flexible to serve each patron's needs and at the same time be able to take advantage of improvements in the technology. Undoubtedly before remote terminals become common tools for library patrons, they must first become common tools for a trained library staff who will use the terminal as one of their tools in providing efficient and effective service to the patrons.

It would be very unfortunate if an automated system which included the capability for user participation in accessing a machine-readable file would eliminate the traditional services. Perhaps some time in the 21st Century people will not want to browse in libraries, read books, ask questions of librarians, receive guidance, listen to stories, and enjoy the library environment. But this is not yet the 21st Century. When computer technology with its remote access devices becomes a common commodity in libraries, for an undetermined time beyond there will always be people who may not always want the kind of library service that machines can give.

Libraries need computer technology with its great capabilities to meet the ever-increasing demand for services, but they also will need to retain for some time the best of the more traditional offerings in order to satisfy all those who are using and will continue to use libraries. In the final analysis, the value and success of a system involving both quality and quantity of library services is probably most properly measured by its worth to the users.

The fact that there is a multitude of problems standing in the way of providing much higher levels of service cannot, of course, be ignored; but much of the groundwork for the technological aspects is being laid, probably more rapidly than some may realize. Machine-readable cataloging, cooperative plans, and the development of networks at different levels are all part of the foundation. Not even the most optimistic will deny the enormity of such an undertaking or be oblivious to the problems, but the optimists believe that eventually the problems will be solved and access to all recorded knowledge will be readily available to all patrons.

The main operational problems in linking all libraries into a national network system are similar in composition to automation problems that exist today but much more intense and far-reaching. The technology is available but needs to be refined and made much more dependable. The costs are high but are expected to come down. The financial, administrative, personnel, and materials problems need to be worked out to the satisfaction of all cooperating institutions. These problems exist now at all levels, but the higher the level the greater the effort required to solve them.

Numerous studies have been and are being made about today's library user; several are listed at the end of this Section (8, 29, 49, 94, 101, 105, 113, 118, 133, 144, 150, 151, 153, 159). The user of the future and his needs must be studied and analyzed even more. In fact, it is possible that he will be studied just as much or more than the operational activities in order for libraries to provide optimum services and receive optimum results from the technology.

In a practical way we know this utopia of individual service and access to nationwide resources is some years off, but the fact that the possibility is real gives a definite and identifiable goal toward which to work.

B. The Library System

Between one thousand and fifteen hundred libraries are now thought to be engaged in automated activities at various levels, but this number still represents only about five per cent of all libraries. Within the remaining libraries there are undoubtedly many librarians who are thinking seriously about automation and are concerned about how best to proceed when planning for their libraries. This concern may be amusing to those who have faced such a responsibility, but it can be very serious for others who feel the pressure.

The steps taken to plan, design, develop, and implement an automated system, whether in libraries or elsewhere, are many and complex. Because of the complexities, automation uses an approach and a number of techniques and practices not ordinarily considered essential in managing and operating a library. However, many of these methods, now considered so much a part of automation, antedate computer technology by many years and can be used effectively in library management, regardless of whether automation is under consideration.

Although this report cannot examine in depth all of these techniques and practices and every detail that goes into creating an automated system, it is hoped that an overview along with a few practical suggestions will be of help to those who anticipate the need for an introduction to systems development.

1. The Library as a System

The first major step, most authorities agree, is to think of the library as a SYSTEM and to use the SYSTEM APPROACH or SYSTEMS APPROACH (either is acceptable). These terms, like "automation" and "library automation," lack precise meanings and are used in different contexts; at times they have very complex ramifications. There is, however, a basic concept, which prevails when discussing systems, that seems applicable to the majority of libraries. This basic and rather simple concept contains the idea that a SYSTEM is an entity composed of parts interrelated, interacting, and interdependent. A short definition conveying this idea was given in an earlier section. A more formal but still uncomplicated definition is "A set or arrangement of things or activities so related as to form a whole and function as a unit." This short sentence implies a working together in the interest of a WHOLE or TOTAL or SINGLE PURPOSE. A library, therefore, is a system composed of many parts working together as a unit under a single administrative authority to attain planned objectives.

The definition is flexible enough to include a one-room, one-person autonomous library as well as a library such as the New York Public Library with its many departments, branches, and agencies. It can also include a conglomerate of libraries banding together under a common authority for a common cause. Thus, if the one-room library becomes a branch or the New York Public joins with others to function as a unit, each then becomes a subsystem of the larger grouping or system. Whatever the details of its structure, a system must suggest TOTALITY.

To use the SYSTEMS APPROACH means to study, plan, design, and implement each part or detail in relation to the whole rather than as separate and unrelated parts. The success of the systems approach depends as much on attitude and the way operations and problems are looked at as it does on the techniques used. The ability to look at operations and problems within the library as a group of single elements combining to form a collective entity is an important ingredient in the plan and design of any kind of system, but it is an indispensable ingredient when a computerized system is under consideration.

2. Study of the Present System

Once the idea is accepted that the library is a system and must be considered in toto, it is generally agreed that the next step is to make a "feasibility study" to determine whether a move to automation would be practicable.

The first task in making a feasibility study is to determine or reaffirm in detail the main objectives of the library; or, to put it another way, the reasons why the library exists. Probably every library has statements resting in its files that spell out in broad and general terms why that library is in existence, but statements should be more specific if they are to be useful in determining a practicable course to follow in the future.

When objectives have been clearly identified, the next task is to determine what needs to be done to achieve these objectives and what can be done within the internal and external constraints under which that library must operate. At this point some libraries have erred by thinking and planning within a scope much too narrow to be useful in future developments. There is nothing wrong with a library deciding to single out one application for immediate attention, e.g., circulation, but what takes place must be in relation to the primary objectives and needs of the total library. Improving the circulation system is only a secondary objective. How anything is to be done comes later.

Before one is able to determine what can or should be done, a detailed study of the present system is necessary. Since so much of what happens in a library depends on the many variables that combine to make up an individual system, the route taken to automation, whether we like to admit it or not, is highly dependent on the present structure of that library. Although all libraries operate within the same general environment and share many common characteristics, no library is exactly like another in every detail. A very few persons involved in library automation (most of them not librarians) feel that studying the present system is a waste of time since the new system may bear little resemblance to the old. Theoretically this may or may not be true, but from a practical standpoint it is difficult to see how a new system can ever be successfully designed without a thorough understanding of what is presently taking place within the library.

In the final analysis the librarians in any library system are the only ones really qualified to make decisions regarding the future direction of that library--automated or not. In order to make sound decisions regarding its future course, they must become very familiar with all aspects of their library and the way each aspect relates to all of the others. To know their library well, these librarians must have complete and reliable data pertaining to its purpose, its policies, its organization, and its operations.

The procedure a library may follow to make a thorough investigation of its own system is often referred to as a SYSTEMS ANALYSIS, a technique which also continues throughout the design and development of a new system. Systems analysis, which actually includes synthesis as well as analysis, requires that the WHOLE of the present system be broken down into its many parts. Each part is studied and evaluated separately and in relation to all other parts. All parts are then put back together to see what is there and what needs to be done.

The depth of systems analysis and the amount of work required to make an in-depth study differ, of course, from one library to another depending on the many variables--type of library, size, organizational structure, administrative attitude, policies, objectives, environment, users, etc. Regardless of these differences, however, the same general methods can be used for study and evaluation.

3. Techniques for Analysis

Over the years many special techniques and practices for scientific management, operations research, and the like have been developed to assist in planning, designing, evaluating, and implementing large-scale projects and to assist in the organization and management of enterprises of all types. Computer technology has adopted or adapted many of these techniques as well as adding new ones. Professional planners, systems analysts, computer specialists, and others rely heavily on a wide assortment of tools and techniques to help them in their work. Some of these planning tools and data-gathering or fact-finding techniques are so complex as to require specialized training and expertise to use them, but others are relatively simple, unsophisticated, and nonmechanical. Within this latter group are a number that can very profitably be used in a library situation, as some libraries already know.

A few library studies have used the more advanced statistical and mathematical tools such as random sampling, PERT (Program Evaluation and Review Technique), mathematical modelling, and simulation (42, 83, 101, 128, 170). Cost studies and Program Planning and Budgeting (PPB) are discussed in part G. of this Section. If these techniques prove feasible, it is hoped they will be used more extensively. For the time being, however, it appears that most libraries are not yet prepared to handle high-level studies and that some are not even very familiar with the simpler ones. On the whole libraries have been slow to borrow from other fields; but as automation becomes increasingly important, they should feel free to borrow whatever is useful to them from any source.

The tools and techniques mentioned below are not regarded as complex, but they can assist a library in analyzing its present system. They can provide answers to the "What, Where, Why, When, Who, and How" types of questions. Some are directed to procedures and others to personnel. All are useful but only to the degree that they accomplish what is intended. A word of caution is in order. In using any tool, technique, or mechanism one must guard against rigidity and the possibility of pushing an idea or an issue beyond practical limits. This is especially true when persons are involved. It is quite possible that some employees may resist analyses of their jobs and duties as much or more than they may resist automation, and without employee cooperation certain activities would be futile. It is very important that all employees be brought into the plans and given good reasons for being checked and questioned about their work. The library is not a factory or assembly line but a place for mental enrichment; it must remain that way. The following tools and techniques should be utilized with that thought in mind:

a. Organization Charts

An organization chart is a graphic representation of WHO (the position) in relation to others--WHO reports to WHOM. It shows the functional relationships, the staff positions, the line positions, and the existing lines of authority. Probably the most common of the planning tools, it is used by many libraries to show the organizational structure.

b. Analyses of Personnel-Job Relationship

(1) Job Descriptions

A job description is a narrative statement of the requirements of a particular position. It should tell WHO (type of person) is to do WHAT (intended responsibilities). It describes what the position entails--the qualifications required of those holding the position and the tasks and levels of responsibility assigned to it. It is intended to describe the qualifications of the person that should be filling the position, not necessarily the person actually holding the position. Most libraries, especially the larger ones and those with employees under civil service, use some form of job description to categorize the positions and for promotional purposes.

(2) Diary Charts

An easy, nontechnical method of getting information to substantiate the accuracy and completeness of a job description and the appropriateness of a job assignment is the preparation of a diary chart by each employee for a few sample days. It is a fairly simple task to list time intervals along one side of a sheet of paper and tasks along the top of the same sheet. Each employee records the time spent on each task and the number of items handled.

The supervisor can easily spot instances of high-level employees spending time on low-level jobs as well as instances where employees must wait for work or have not been properly trained for a particular segment of the total job. Diary charts can be of value in making job description and job specification statements consistent with the realities of the situation.

The use of diary charts should not be undertaken to collect ammunition for disciplinary action but rather to point out weaknesses of the system and illogical job assignments.

(3) Questionnaires and/or Personal Interviews

Questionnaires and personal interviews provide a means for finding out WHO (actual) is doing WHAT (actual). Personal interviews are the best means for gathering these data, but they are time consuming and therefore costly. Questionnaires provide greater coverage in less time and at less cost. Many organizations combine the two by interviewing a sample of the total staff and obtaining data from the others by questionnaire. Whereas job descriptions detail what is supposed to be done and diary charts substantiate their accuracy, questionnaires and interviews should attempt to probe more deeply into what is actually being done. An effort should be made to compare the results of the questionnaires and interviews with the job descriptions and diary charts in order to get some reading on how well the incumbents are fulfilling the job requirements as originally described.

(4) Motion and Time Studies

Motion and time studies (a stop-watch type of operation) are not used as much now as in years past. These studies have been replaced by newer statistical techniques, but occasionally they are of value. Some libraries have conducted motion and time studies in connection with moving, packing, unpacking, and other physical operations.

The above four methods of analyzing personnel in relation to their jobs have been in existence for many years. A recent paper by Surace, "The Human Side of Libraries" (145) discusses another and in his opinion, better method for evaluation and analysis of people. He examines three methods: (1) work measurement (motion studies, etc.) which equates humans to an assembly line; (2) job description which begins with a rigid standard but is altered by the human factor of employee modification; and (3) management by objective, which he favors. The trend in business is toward free communication and the need for establishing "human" oriented standards and employee evaluation. This new approach, based on systems of work flow, disturbs the distinct department identity but promotes better understanding between the head librarian and the staff by translating the goals of the institution into common employee goals. Managers or supervisors, Surace emphasizes, get things done through people so they must understand the human side of enterprise.

Because automation emphasizes the total interrelated system rather than a collection of individual and isolated parts, this newer method appears worthy of consideration in libraries.

c. Flow Charts

A flow chart is a graphic representation to show the logical sequence of tasks--WHAT is taking place or should take place and the order in which each task occurs. There are many kinds of flow charts from a broad block diagram giving an overview and sequence of major operations to a detailed chart showing every individual step. Although the techniques of flow charting have existed for years, they have become well known and established since the arrival of automation. Automated systems could not be designed, developed, or implemented without them. Systems analysts, programmers, and all other computer specialists consider flow charts their principal medium of communication. Flow charts required in automated systems can be extremely complicated and detailed, but libraries will find even simple charts very useful in describing manual operations. Properly prepared flow charts identify duplication of effort, redundant operations, bottlenecks, and other inefficient practices by graphically representing the steps taken to accomplish certain tasks.

d. Work Flow Diagrams (often called Flow Diagrams or Layout Charts)

These diagrams are graphic representations to answer questions related to WHERE and HOW. They usually consist of floor plans drawn to scale and the location of furniture and equipment in the work areas, with superimposed lines and arrows to indicate the physical routing of materials and the movement of personnel. They are a good means of finding out how efficiently materials to be processed are moving from station to station and how much physical movement of the staff is required to accomplish the work. Diagrams of this type are often used to plan new quarters prior to a move or when planning to rearrange offices and work areas in the present location. Libraries have found these diagrams useful in the technical services area where materials must move through the many processing steps.

e. Forms Analysis Charts

A forms analysis chart is a check sheet for printed forms to eliminate duplication of information, the collection of unneeded information, and the retention of forms beyond the time the information on the forms is of value. An important function of forms analysis is to make sure that the information on each form is recorded in the order in which it will be used as a segment of the total system. The number and kinds of forms being used in an organization tend to proliferate quite unintentionally unless an effort is made to evaluate their worth. If nothing is done to control them, they can accumulate long after they have outlived their usefulness. Forms currently in use should be reviewed on an ongoing basis for design, number of copies, arrangement of content, disposition, and cost. New forms in the process of being designed should be given similar treatment. Libraries will find this type of review and analysis useful in coordinating the forms that are used and in eliminating unneeded files and records.

f. Policy and Procedure Manuals

Policy manuals are prepared to serve as an institution manual giving the history, policies, objectives, and related data pertaining to the organization. Procedure manuals describe in detail a limited operation and are used for instructional purposes. No doubt a combination of these two types of manuals is of greatest over-all value. In other words, the policy manual can be prepared in such a way that it can become a section of each procedure manual. Procedure manuals should present the work of a particular segment of the system in detail, giving the flow of responsibility (organization chart), the flow of work (work flow charts), forms used, and instructions relating to how each job should be done.

It is important that manuals be produced so that sections can be revised to conform with new procedures without writing the entire manual. It is also important that manuals be kept up to date to serve as a tool for orienting new employees.

Once the data are gathered, they must be analyzed and evaluated. Each of the techniques described above, though not an end in itself, is a very useful means to assist librarians in making in-depth studies of their present systems. Collectively they lend support in identifying bottlenecks, duplicated effort, uneven staffing, inefficient or unnecessary routines, and other inequities and inefficiencies. They help to answer a most important question, "Why?" They also help to answer other questions, such as: "Is it necessary?" "Is it worth the cost?" "What will happen if we no longer follow this procedure?"

They can provide much of the basic information needed to decide on a system for the future.

4. Design of a New System

The details necessary to design and develop a new system are many and varied, and call for decisions to be made at every step of the way. Just as systems analysis of the present system reduces the WHOLE into elemental parts, so must this process continue into the design of a new system. As stated before, the objectives must be defined. Based on the decisions made relative to these objectives and any identified constraints, a structure of a system can then be laid out. This structure or framework should incorporate the WHOLE, even though only one or two segments may be selected for development and implementation.

Alternative methods for achieving objectives may be generated, and each one evaluated in terms of both efficiency (economic) and effectiveness. Simulation and model building are effective ways to test different methods and determine results without actually performing the real tasks. Ultimately a choice has to be made. Pilot operations, testing and evaluation, feedback, modification, more testing and evaluation, and more feedback are all part of the work that goes into bringing a system from "paper" planning to implementation.

An automated system must be flexible and open ended to allow for changes and expansion in the future; it must be adaptable in order to survive and it must provide feedback to keep it on course.

The fact that libraries rarely have an ideal situation when they engage in automation should not be the deterrent that some allow it to be. Money and trained personnel are usually not as plentiful as one would like, and the equipment is not always completely satisfactory. However, because so much creditable work is being accomplished under such handicaps, once again it must be pointed out that a constructive attitude on the part of the library administration and staff as well as the results of proper planning contribute much more to a successful endeavor than most people realize.

A few librarians have been aware of the techniques of scientific management for many years and a number of articles appeared in the '40's and '50's, but this approach was not then considered standard library practice. Within the last several years, perhaps because of automation, literature on systems and the techniques used to study them has been increasing.

In addition to the references cited earlier in this part of the report, those listed below are relevant to the library as a system:

Adelson (1), Bellomy (12), Boaz (17), Burkhalter (24), Chamis (25), Dougherty and Heinritz (40), Gull (56), Hayes (60), Heinritz (62), Herner (64), Jestes (69), Kozumplik (79), Leonard (84, 85), Maier (91), Pings (115), Pizer and Cain (116), Schultheiss, Culbertson, and Heiliger (131), Simms (136), Simpson (138), Snyder (140), Voos (154), Waite (155), Wessel and Cohrssen (162), Wessel, Moore, and Cohrssen (163), Wessel (164), and Whitehead (165).

Others appear in the LOCATE and ERIC Bibliographies and all volumes of the ADI/ASIS Annual Review.

C. Library Organization

The internal organization of libraries is undergoing change for a number of reasons, not all directly related to automation. There seem to be, however, two fundamental considerations pertaining to organization that are relevant to automation: (1) the division of activities within a library, and (2) the question of whether present library organization can cope with the library's changing role.

1. Division of Activities

A great deal has been said about the resistance some librarians have shown toward automation although no one really knows how serious this is. Some is vocal and identifiable, but there may or may not be the more surreptitious type that is difficult to pinpoint. Certainly it is understandable that librarians might be apprehensive, especially if they do not understand what automation can and cannot contribute to library operations and services. Perhaps a look at the unique contribution librarians as professionals are expected to make versus the contributions of other people along with machines may help to clear up any misunderstanding.

If one looks closely at what takes place within a library, one can identify two distinct sets of activities. For want of better tags these are labeled Basic Activities and Supportive Activities.

Basic Activities are concerned with what is taking place in a library that is unique to librarianship; the combined responsibilities entrusted to the library profession as opposed to responsibilities entrusted to other professions. For example, most will agree that the library professional is responsible for determination of library objectives, determination of library policy, development of the library collection, bibliographic organization of the library collection, and professional assistance to users through an extensive array of library services. Is there another profession capable of assuming these responsibilities? The answer should be that there is not. These components of basic activities belong completely to librarians and to no other profession. The level of work is expected to be primarily intellectual in nature and implies the use of creative and scholarly talents. Thus, a Basic Activity belongs in the library and is the prerogative of the librarian.

Supportive Activities are concerned with all other affairs that take place within a library to support the Basic Activities. This support includes the operational routines, the control functions, the maintenance of records, the physical plant, the assisting tools and equipment, and the management and coordination of these various elements. These elements are sometimes given rather unique treatment by libraries, but the elements themselves are not unique to libraries.

They are present in some form in almost all organizations. It is within these Supportive Activities that automation is playing its major role.

Today's libraries are organized in such a way that the two--Basic and Supportive--are intermixed and difficult to separate. Both are found in the same department and often performed by the same person. Unfortunately, automation per se and the supportive work it performs have received so much attention in recent years that many people, including librarians, seem to have lost sight of the more important Basic Activities. The actual separation of Supportive and Basic may never be possible in some kinds of professional positions, and it is not suggested that undue effort be exerted to make a separation. But what seems to be over-emphasis on the Supportive as opposed to the Basic by some professionals suggests that a change in point of view rather than physical tasks could improve library environment.

The positions of some librarians may change as a result of automation. Any resistance or objections to change are not likely to dissipate unless an effort is made to clarify the differences between these two types of activities. If positions within a library system even come close to being properly aligned, it is difficult to see at this time how any position worthy of professional talents can be jeopardized. The computer is only a tool, and with its able assistance the library profession can be enhanced and enriched rather than subverted.

2. Present Library Organization and the Future

Present library organization seems to be mostly a hierarchical arrangement of departments and divisions that eventually converge at the top in the office of the director or chief administrator. This is not an uncommon arrangement as it is present in many organizations. Two practices, however, seem to be characteristic of many library organizations: (1) They tend to have more subordinates reporting directly to the top than good management practice recommends, and (2) Their departments and divisions are such that each tends to work independently and in relative isolation. This is probably not the case in all libraries, but it does not seem to be uncommon.

This second practice, in particular, is affected if a library engages in an automation program that involves more than one or two applications. As has been explained before, optimal results of an automated system can only be obtained by close interaction and interrelationship of those involved.

As a result, a growing number of librarians are concerned not only with the confused mixture of Basic and Supportive Activities but also with the question of whether the traditional organizational structure is capable of meeting modern needs and of coping with the demands from outside and existing problems from within.

A number of interesting articles directed to these problems have appeared in the literature in recent months (58, 77, 112, 122, 139, 149, 166). Whether or not one agrees with them, one cannot ignore the fact that the present organizational structure in libraries is being challenged. Several of the authors suggest or imply a more distinct separation of Basic and Supportive Activities. There are several possibilities. One suggestion is to introduce into the library a new group of professionals from the outside such as managers, systems analysts, and computer specialists. Another is to recognize new specializations within the library profession, retaining the present recognized specializations and adding others in such areas as library administration or management and library automation.

Along with this new division of responsibility authors also suggest the need to give more recognition and remuneration to non-administrative librarians engaged in the Basic Activities. This would make their position levels more nearly equivalent to those in administrative positions. One can assume from the literature that there is considerable internal dissatisfaction among professionals regarding status, professional recognition, salary scales, promotional policies, lines of authority, etc. Although some of this agitation can probably be attributed to our national state of unrest, some of it is undoubtedly caused by the pressures within the libraries and the presence of automation.

The general feeling seems to be that libraries are becoming such complex organizations that the present criteria for selecting administrators and for allocating responsibility to other professionals are not adequate for the future and that the organizational structure existing in many libraries needs a complete overhauling.

Large libraries rank with large businesses in their total budgets and staff size. It is doubtful whether they can meet their Basic-type commitments without a great deal of professional help from the Supportive sector.

In using the necessary professionals in the support operations, the question is whether it is better to train and retrain librarians to assume these responsibilities or to seek professionals from the outside. This question deserves serious consideration. If professionals other than librarians are recruited, some provision must be made to recognize their professional standing in the library. Otherwise libraries will have difficulty recruiting enough competent people to maintain continuing successful support.

D. The Administrator's Role

As indicated previously, automation may quite possibly cause some rather important changes in the organizational structure of libraries. Nothing has yet become well enough established to draw any definite conclusions about changes in the role of the administrator. It seems reasonable to assume that administrators of the future will continue to have the dual responsibility of directing both Basic Activities and Supportive Activities. It is quite possible there will be considerable change in managing the affairs of the Supportive group. Much will depend on the progress made in machine-readable cataloging, centralized processing, cooperative programs, network developments, and other functions that rely heavily on supportive operations.

It is important for an administrator to be able to recognize his responsibilities in automation management. In the absence of more definite guidelines, it may be of some value to ponder what others have learned and to consider some of the implications.

1. What Others Have Learned

Automation in libraries has not yet advanced far enough to give the subject of management much attention, but business and industry have had considerable experience in attempting to identify management's role. They have a longer history and broader experience in the use of computers; they have made a special effort to analyze the problems of computer utilization. Although the relationship between the library director and top management of business is not strictly one-to-one, a number of conclusions resulting from business studies should be of interest to the library director.

Business and industry have long accepted the axiom that the quality of executive leadership determines the fate of an organization. Because it has been theorized that the effects of the "Computer Revolution" will be greater than those of the Industrial Revolution, the business and industrial community has spent much time and money trying to find out how effectively computers are being used and what effect they have on management.

Periodically surveys are made by trade publications, management consultant groups, and professional associations to gather pertinent data. Over the years they have come up with fairly consistent conclusions. One of the most important is that of the thousands of major computer installations in this country, two out of three are unsuccessful or marginal because they are not doing as much or as well as they should with the facilities available.

The second equally important conclusion is that the major reason for not getting a "payout" from the computer is not technical but managerial and organizational. The fact that these were the results of more than one survey and study lends further emphasis to the importance of strong leadership.

These conclusions may seem strange when so much attention is being given to the shortage of programmers, operators, and systems people as the source of most of the problems.

The studies further point out that the sharp difference between successful and less successful organizations depends on the attitude of the top executive and his ability to set forth clear-cut objectives, to focus on major problems, to marshall adequate resources to get the jobs done, and to overcome human and organizational barriers. Successful companies make careful feasibility studies before approving computer applications and require the development of tools for planning and controlling computer efforts.

The person responsible for computer applications reports directly to the top executive or the one next in line but not three or four levels down. He takes the major responsibility for the end results produced by the computer system and for the success of putting the computer to work profitably. If necessary, he is given special training in the significant management resources of the organization to enable him to understand the whole company and relate his work to it.

Contrary to popular opinion, the surveys have found no evidence that the capability of the hardware per se has limited the benefits derived or that the length of experience with computers guarantees success.

Of particular interest to library administrators should be the recognized importance of executive planning and feasibility studies, and of the necessity for putting the head of computer applications close to the top.

2. Implications for the Library Administrator

The need for strong and decisive leadership and the fact that final decisions must rest with the top administrator are no different with automation than they were before. Automation has at times tended to obscure these fundamental responsibilities.

Precisely what an administrator should know about the technical aspects of automation depends very much on the individual. Like other people, administrators have special interests. Some will have a great affinity and have no trouble in understanding the intricacies of computer technology. For others it will be a real effort to become interested.

As a minimum, it seems that the director of a library ought to acquire enough basic knowledge so he will not always be at the mercy of other people. He should know the fundamentals of computer technology in order to understand what computers can and cannot do, the inherent problems, the cost factors, and to what extent automation can help in reaching the objectives of his library. With this minimum of knowledge a director will have to depend on others to provide the expertise for the details of design and implementation. But even with an expert at his side, the director is still responsible for the final decisions. His own knowledge should be extensive enough to communicate intelligently with computer and systems specialists and to be able to accept their ideas and suggestions with some degree of discrimination.

Business and industry have had the problem of acquainting managers with computer technology and keeping them informed of new developments. They have found that special courses or programs, often given by an association or an academic institution, have been effective in keeping management up to date. They have also learned that short, concentrated programs lasting a few days or weeks tend to be more successful than those spanning longer periods of time. The library profession has barely made a beginning in short-course programs, but the experience of others indicates that this is a successful route to follow to inform librarians in the field of new developments.

Administration or management and the principles and practices that lead to success have occupied the time and thoughts of many writers and speakers. Those who write for the library field tend to direct their remarks to one type of library or librarian, e.g., public, academic, special; but most of those cited here offer suggestions and identify problems that are relevant to general situations (23, 51, 71, 74, 90, 98, 111, 137, 141, 147, 158, 168).

Administrators of libraries in the future will require more extensive technical knowledge than most of them now have. Sensitivity to the need for change and a disposition and readiness to make changes are even now more important than they have been in the past. Levinson (86) suggests three obvious principles necessary for a management career:

- Every man should prepare himself for maximum flexibility.
- Every person who pursues a career, as distinct from a jobholder, should expect to continue his education for the rest of his professional life.
- A man's own feelings are the most powerful agents of obsolescence.

The understanding and motivation of personnel, though sometimes neglected, has always been an administrative responsibility. Administrators of libraries will certainly become more closely involved with other library administrators because of the trend toward coordination of resources, which will require more formalized relationships than have been necessary in the past.

Administration is the keystone of any organization; no organization will run itself or exist long without reasonably good leadership. Automation may change some of the techniques and the details of an administrator's responsibilities, but it will not change the reason he was put there in the first place--to lead.

E. Personnel

The very word "automation" has been so successful in conveying the idea of a machine that one can easily lose sight of the fact that automation involves both men and machines. Much of the resistance that has come from many segments of the population including librarians has undoubtedly resulted from the over-emphasis on machines at the expense of humans. And yet, in spite of the tremendous capabilities of modern-day computers, people have been and will continue to be our greatest asset. Contrary to the impression often given by the vendors, automation has not reduced over-all employment; it has increased and rearranged employment. It has put people in different kinds of jobs, most of them at much higher levels.

One of the most difficult personnel problems, long recognized by business and industry, is that we know very little about each other. Current social issues in this country and our experiences in foreign affairs have shown how little we understand the human personality. Our ability to communicate fully with each other and to judge what people can do, want to do, and will do is on the whole quite poor. "Lack of communication" or "poor communication" has been a chronic complaint of librarians in their contacts with computer people. Because we are not as adept at handling people as we are at making things, we find people difficult and full of surprises, unpredictable and often troublesome.

We may lament the limitations of the equipment, but we can know in advance exactly what it can and cannot do. We may consider the budget inadequate, but a firm figure does exist on which to formulate plans. But with people it can be a different story. People have the power to make or break a system, be it social, economic, or automated; and the attitudes they bring to their jobs can have a great deal to do with the success or failure of an operation.

In this country manpower has become our most costly budget item, in libraries and elsewhere. This is one reason why the use of mechanical devices of all kinds has been so successful. It is also one reason why data processing equipment was introduced into libraries. This is a very sound reason why every effort should be made to place people in positions for which they are best suited and to use their talents to the best advantage.

Personnel problems to some degree will always be present. Automation has created some new ones for libraries and has aggravated some of the old ones. In the following paragraphs some of the more common personnel problems are discussed along with a few suggestions for easing them.

1. Problems Inherent in Automation

a. The basic law of supply and demand

At the present time there are not enough librarians with systems and/or computer training and experience to fill the needs of libraries. Those who are qualified, or even partially qualified, find a ready market for their services. As a result, they tend to be mobile, taking advantage of opportunities as they arise.

Similarly, the number of computer specialists, systems people, and machine operators interested in library work is limited; and their mobility is even greater. While librarians usually move from library to library, computer people are welcome anywhere. Thus, libraries are competing with all kinds of enterprises for the services of these specialists.

Because these people are in the "driver's seat" in negotiating for their services, some, quite understandably, have advanced much higher and much faster than their qualifications and their capabilities would normally dictate. Some obviously underqualified people have been ridiculously successful in capitalizing on such titles as programmer, systems analyst, scientific management expert, and even library automation expert--quite the reverse of librarians who sometimes are overqualified for the work they are doing. Unfortunately these people have literally mesmorized some administrators into attaching an infallible and omniscient quality to their judgment.

Administrators should bear in mind that as yet there are no standards, certification requirements, or specific professional qualifications determined for any of the positions in the electronic data processing field. Prospective employers would do well to probe more deeply than just taking someone at his word. The greater the responsibilities attached to a position, the more necessary it is to make thorough inquiry. This fact may be obvious to most, but the aura of mystery that has pervaded the technology has to some extent included the people involved.

Even though the number is growing, there are still a limited number who are fully qualified to design and implement automated systems for libraries. Many libraries may, therefore, have to employ those who are in the process of being trained. A point to remember in this connection is that a supervisor should be aware of what the person is capable of handling and be cautious in the assignment of responsibilities. It is one thing to hire someone who realizes he is still learning; it is quite another to hire one who does not know much but thinks he does and is able to convince those who employ him.

b. Necessity for training and retraining

Libraries are finding it necessary to engage in much more on-the-job training than they have in the past.

Clerical employees are being converted from typists and clerks to machine operators. This training is not difficult and has the advantage of using people already acquainted with the library system.

Computer and systems people coming into the library must become familiar with library operations to understand what is expected of them. The experience of some libraries indicates that these people will be more interested if they are employed by or assigned to the library. Those whose allegiance remains with the computer center or some other group are more difficult to orient.

Librarians who are a part of the "automation team" must receive some special training in the techniques of automation in order to carry out their responsibilities. Much of this will probably have to be done outside the library.

All employees, regardless of their status, should be apprized of any new plans and developments and should be given some type of introductory training, if for no other reason than to be able to understand what is happening.

Because the number with sufficient "know how" to operate a system is limited, automation in some libraries has become something of a personal activity, circumscribed by the knowledge, the capabilities, and even the whims of one or two people. This has been particularly true in the choice of computer programs and, in a few cases, in the choice of equipment. This is not necessarily a handicap if an adequate "back up" staff is being trained.

The danger always exists that if only one or two key people are familiar with a system, the whole system may collapse upon their resignation because a replacement is not available. More than one automation project has stopped completely, and others have been delayed because a key person left before anyone could be trained to take over. Such a situation can be serious at any time, but especially so when a system has been operational long enough to discard the old procedures but not long enough to be routine for those who must continue.

Courses, workshops, seminars, etc. given outside the library can help with the training; but until these programs become better organized, libraries will have to assume much of the responsibility for training and retraining within their own institutions.

c. High turnover

High turnover is not unique to the field of automation but is frequently mentioned as a major problem. It occurs at all levels but particularly among the machine operators and clerical employees. Aside from the outside competition for services of computer personnel and the normal mobility of the work force, much of the high turnover can be attributed to the nature of the work and to employment practices.

These jobs are often held by women--some only temporarily in the labor market and others always looking for something better. In many organizations machine-operator jobs are dead end, tend to be mechanical, routine, and uninteresting, and are classified as very low-level positions.

Within each type of position, some effort should be made to assign grade levels and attach appropriate titles. This would separate those with experience from the beginners. A further incentive for most employees is to tell them the possibilities that exist for moving up in the organization.

d. Quality control

For all of its excitement and glamour, automation is very demanding. Accuracy is even more important than in manual operations because an error has more far reaching and longer lasting effects. Accurate machine operations, proofreading, and editing are absolutely essential for accurate records.

Any one of these jobs can eventually become dull and monotonous unless preventive measures are taken. Instances have been reported of clerks and machine operators being very interested in their work while the project was in the experimental and testing stage. As soon as it became operational, the excitement was gone, the work became routine, and errors increased substantially.

Proofreading and editing require great concentration and the ability to make decisions. The accuracy and usability of the output records are highly dependent on the accuracy of the input. Usable computer-produced data require careful preparation and equally careful handling all along the line. At times highly routinized tasks become very taxing and in turn can result in masses of inaccurate, unusable records.

Because accuracy and quality control are so necessary for machine processing and machine-readable data, supervision is especially important. A good supervisor will recognize that some kinds of work are not very interesting over long periods of time and will do everything possible to provide some variety in job assignments. Rigidity and a fixed operating program are fine for machines, but a little diversification will produce better results when working with people.

e. Poor communications between librarians and computer people

The complaint that communication between librarians and computer people is poor has been heard from the beginning. In the early days it was understandable that librarians knew very little about computers, and computer personnel knew nothing about libraries--they were not speaking the same language. Time will take care of some of these problems, but librarians should assume the responsibility for improving communications. After all, the quality of service that the library renders to its patrons, not the quality of computer records, measures the success of the whole undertaking.

2. Suggestions for Handling Some of the Problems

a. Probably the best means for easing the shortage of personnel capable of designing and implementing an automated system in the library is to encourage more librarians to become interested in automation. Competition for computer personnel and systems people will continue for some time to come. Computer-oriented persons often are not especially interested in the type of work required by libraries. On the other hand, those who have become seriously involved in library operations have been exceedingly successful and have made outstanding contributions. Nevertheless, eventually libraries will probably be served best by having their own professional staff members become the leaders in automation activities. This does not imply that others such as systems analysts and computer specialists will not be used, but rather that the librarians themselves will be capable of designing and managing a system and of assuming leadership in all phases of librarianship.

The curricula of library schools must be revised to meet these changing needs and better programs of continuing education will be needed. These are discussed in more detail in Section VI.

b. Libraries can take certain measures which will attract a greater number of capable systems and computer people. Although all libraries cannot always compete with business and industry in salaries, they can offer many unique advantages and an attractive environment. Library operations offer some interesting challenges that do not exist in straight business-type operations; such challenges might appeal to the creative, ingenious person provided he is made to feel welcome and is given some freedom to put his ideas to work.

c. Library administrators should develop relatively definite formulas for rating the various jobs and positions that make up the total work force of the library so that equivalent positions have equivalent salary ranges.

Factors such as education, training, skills, experience, responsibilities, etc. that have been considered in placing a given job at a certain level should be known to all employees. Every employee ought to know what it takes to prepare for the job ahead. Supervisors need the information to plug the weak spots and to help those supervised prepare for advancement.

Cases have been reported where programmers, analysts, and machine operators in the same institution were willing to be involved in library operations but were not willing to transfer to the library payroll because the salary scale was lower. An administrator is asking for trouble if he does not have a sound basis for the salary structure in his organization.

In an ideal situation an employee is doing the job to which he has been assigned, learning or preparing for the job ahead, and helping the person below him prepare to take his job when he has moved up to the higher level position.

d. Keeping the number of dead-end positions to a minimum and offering reasonable opportunity for promotion in both professional and nonprofessional categories will help to counteract high turnover at all levels. The fact that an employee knows there is a chance to advance, even though it may be slight, improves morale and motivation.

e. It would be interesting to know just how much serious resistance there is to automation. The literature implies a great deal, but one might hope that some of what passes for resistance is really lack of understanding. Bringing all people into the program by keeping them informed of what is taking place and why it is being done is one of the best ways to counter either resistance or lack of understanding. Procedure manuals, instruction manuals, and other forms of written communication are excellent means for training and informing and for controlling the flow of work. They take time to write and update but are well worth the effort as part of the training program or simply as a means to convey reliable information to members of the staff. There are always some who resist change no matter what happens, but general experience indicates that the great majority of employees will cooperate if approached in a proper manner.

The shortage of qualified personnel continues to slow the progress of automation in the library. The consensus of those experienced in guiding library automation projects is that the library is served best when it can maintain its own staff of analysts, programmers, and systems-oriented librarians working together as a team. A group of this type can give stability and continuity to projects and can provide adequate back-up personnel in case of staff changes.

The importance of personnel in an automated program cannot be over emphasized. In years past a few organizations operated under the false assumption that, given enough money and machinery, a system would run by itself. Any system also requires the best human talent available. Automation is too complicated and too expensive to become just an extra activity for librarians who are already fully occupied. Anything beyond the simplest applications requires a large percentage of the time of at least one highly placed professional, with guidance and final authority coming from the top.

The introduction of data processing equipment has caused personnel changes and problems in libraries. A number of interesting articles addressed to the topics of personnel and manpower appear in the list of references at the end of this Section (3, 38, 55, 121, 143, 168).

Personnel management will always be a problem, but the problem can be tempered with wise and precautionary measures. We must accept the fact that, troublesome and unpredictable as they are, people are still the most important component of any system. Without them the library would be just another warehouse.

F. Equipment--Hardware and Software

In an ideal situation, a library should determine its objectives, design a system that will satisfy these objectives, and secure equipment and supporting software that is neither too little nor too much but "just right" to handle the requirements. In practice, as everyone knows, these ideal situations rarely, if ever occur, and in libraries they are unlikely to occur for several reasons.

In the first place data processing equipment was developed for purposes other than library operations, so a computer tailored specifically to library needs does not exist. Although the technology is coming closer to meeting library specifications, whether manufacturers will ever consider it economically feasible to produce a special-purpose machine for library use, as some would like, is rather doubtful.

A second limiting factor is that the great majority of libraries have little or no voice in the selection of the hardware that they use, unless it is located in the library. There are a few exceptions, but most must depend on services from a facility over which they have little control.

A third factor making the situation less than ideal is the budget problem. If a library has determined its major objectives and drawn up the specifications for a suitable system, budget limitations may curb, postpone, or even present implementation of the system as originally envisioned.

A fourth problem libraries have had to face is the lack of computer programs (software) written especially for libraries. Here again the high-level languages have been designed for other purposes, and libraries have had to adapt them for library use.

In spite of these problems, computer technology has a great deal to offer libraries, even in its present state; and in considering hardware, libraries are faced with a number of decisions. The selection of a specific computer is, of course, one of the most important; but it is too complex to be discussed here. Not only is it difficult to generalize about the selection of a computer, but often the final decisions depend more on local circumstances than on actual library needs.

Two areas that are also important and yet not too involved to discuss are: having a computer in the library versus using outside services; and choice of input equipment.

1. Location of Hardware

Most libraries, at the present time, are using computers located elsewhere; but, if there is an opportunity to have a choice, where and how a library will receive its computer services becomes a fundamental consideration. The choice is between having a computer located in the library or using an outside center. An outside center can be a computer center of the institution or central agency to which the library is attached, a cooperative center shared with other libraries, a centralized processing center specializing in library work, or an outside commercial service bureau. Each has its pros and cons.

a. In the Library

The idea of having a computer under its control appeals to many libraries. Parker (110) has long advocated the computer in the library or several libraries sharing a computer system. He contends, and it is true to some extent, that the best service is not forthcoming when processing is done by outsiders on computers intended primarily for business routines or scientific research problems. On the other hand, some libraries are satisfied with such an arrangement.

If a library expects to do more with the computer than have an occasional listing, it needs a firm schedule and high priority for service. A computer in the library assures this level of service. Ready availability and ease of access allow more flexibility in planning and scheduling. The staff can concentrate wholly on library work, suitable computer programs can be prepared, and delays should be minimal. The computer and the attending staff are under the control of the library and responsible to no other authority. These are plus factors.

There are also minus factors, all of which are not necessarily disadvantages. The presence of a computer requires a staff of systems analysts, programmers, and machine operators, which may or may not be a blessing. If any of these people are drawn from the present staff, they will have to be retrained. If new to the library environment, they will have to be trained in library operations. Library requirements are too complex to use beginners brought in from outside; and since experienced people are in short supply, the library will undoubtedly have to offer salaries at least close to what others are paying, which may be higher than for comparable positions already existing in the library. A new group of people requires space in which to work and supervision to coordinate their work.

Hardware is always a major expense. If purchased, a maintenance charge to keep the equipment operable is a regular monthly expense in addition to the purchase price, which is usually amortized over a period of years. In most cases renting or leasing is preferable to outright purchase because of early obsolescence.

When renting or leasing, the user is charged a minimum rate, usually based on 176 hours per month (one shift) with additional charges for extra hours of use. An idle computer, therefore, becomes very costly, for the rental is the same whether used for one hour or 176 hours.

An alternative to an idle computer is to do work for others, preferably libraries. This practice has worked well for Cuyahoga County Library since the processing that is done for others is similar to that done for the Library. On the other hand, if the contract work requires different computer programs and procedures, a whole new set of problems may arise.

A further point to consider is whether the library can afford a computer installation large enough and with sufficient capabilities to handle the work planned for the system. If the system calls for random storage, online access, large main storage, or complicated programs, for example, a modest installation with simple batch processing features would not be completely adequate. At this time it is doubtful if any but the very large libraries could justify a large, sophisticated installation solely for the use of a single library.

For even a modest installation the housing requirements for the computer must be considered. Such questions must be answered as: Is the building adequate for the computer installation? Can the library afford to give up the space required? Is there a satisfactory location within the building capable of bearing the weight of the machines? What are the possibilities for having air conditioning, humidity control, heavy duty electrical wiring, raised flooring, etc.?

b. Outside the Library

Academic and special libraries tend to use the computer installations within their own organizations. These facilities vary widely from campus to campus and from one organization to another.

Some campuses have one large centralized computer center while others have several. One rather common arrangement is to have a large center for the administrative functions of the college or university--admissions, registrar's office, accounting office, etc.--and one or more other centers devoted primarily to research projects. Regardless of the center the library chooses, it becomes a "customer" along with other users. Based on the experiences of a number of libraries faced with this situation, the consensus is that libraries should opt for the business-oriented rather than the research-oriented center. Research-oriented centers tend to change the hardware and programs, often as part of the research, and are interested in equipment that is new and experimental. Such use of the center advances research but plays havoc with library processing. If there is one large centralized center, however, it is usually organized to handle both the business and the research projects.

The problems in special libraries are, for the most part, similar to those in academic libraries. Public libraries are often requested or even required to utilize the computer facilities of the city, county, or state.

The advantages of using these centers are more or less the disadvantages of having a computer in the library. The library will probably have access to a much larger installation than if it were in the library. The library is relieved of the responsibility for supervising a computer staff, for housing and maintaining the equipment, and for using the equipment enough hours each month to justify its cost. The library is charged only for the services used. Furthermore, the expertise that is assumed to exist among the analysts, programmers, and operators of a large facility would probably be available for assistance to the library.

But there are also disadvantages. The library does not control the facility and is just another customer, taking its turn along with the others. The importance of priorities and firm scheduling depends somewhat on the library's requirements. If daily circulation lists, up-to-date "in process" files, serials check in, online access, and such are part of the system requirements, high priority and strict scheduling are of paramount importance. Unless the library has confidence in the abilities of the computer center staff and the promises they make to maintain a reasonable schedule, negotiations can fall apart.

At times computer people have been so inconsiderate as to change equipment and executive programs without notifying the library in advance. Such action can be disastrous. Sometimes, too, the computer center is located some distance away and the sheer physical effort of transporting cards, tapes, and printouts becomes a problem. A regularly scheduled messenger service can help.

An alternative to either one's own computer or the institution's facilities is an outside facility--either a cooperative center shared with other libraries or a commercial service bureau operated by a computer manufacturer or as a private enterprise. Most manufacturers, such as IBM, General Electric, and Control Data, maintain separate service centers; and private bureaus are growing at a rapid rate. Libraries as yet have used these services only sparingly, but most of those who have are pleased with the results.

Parker has suggested that several libraries join together to operate their own system. For many libraries this may be the answer to adequate facilities for automation.

2. Choice of Input Equipment

Raw data, e.g., the contents of an LC card, must be converted into digital or machine-readable form before it can be processed on any data processing equipment. The technology has not yet advanced to the stage where we can speak to the computer or offer it a printed LC card and have the spoken or printed words converted to machine-readable form. Rather, it is necessary to keyboard letter by letter and word by word every bit of data to be entered.

At the present time there are five principal means of preparing input: punching holes in cards (the well-known punched card); punching holes in paper tape (such as is done by the Flexowriter or Dura); keying onto and thus encoding magnetic tape; typing or keying at a terminal connected online to a computer; and typing on a typewriter with a special OCR (optical character recognition) font that produces typed copy which can be scanned by OCR equipment and converted into digital form.

Each method has advantages and disadvantages or limitations. Simmons' article, "Choosing Data Conversion Equipment" (135) discusses each one in some detail as well as the major criteria to consider for selection.

When a library decides to convert its bibliographic records to machine-readable form, it usually has made provision to handle the current materials as they arrive; but the big problem many libraries face is the conversion of the retrospective records or the current catalog. This is a one-time undertaking, and the library must decide whether to add more machines and operators for the life of the project to get the job done, to sandwich the work in with the regular work, or to have someone else do it. Several, such as Michigan State and the University of California, Santa Cruz (16) have used outside service bureaus with great success.

Regardless of where the conversion is done, the general consensus is that libraries should be responsible for the input. This includes designing the format for input such as described by Kennedy (73), preparing the basic records from which the operators key the data, and proofreading the records after conversion.

Although some use outside service bureaus for retrospective conversion, the majority appear to have equipment within the library to handle the current input requirements--keypunches and paper-tape typewriters are now the most common.

An article by Hirst (66) describes the use of an IBM MT/ST for preparing input. This typewriter device, not included in the five mentioned earlier, is used to prepare hard copy and a magnetic tape but is not online to the computer. The tape then must be read onto another magnetic tape which a computer will accept.

Several experiments have been conducted with input equipment. Those at Harvard and Michigan State are described in Section IV.B. Hammer also describes an experiment using keypunching equipment (59).

Although the punched card continues to be the most used form of input to computers, newer devices are replacing the cards in many installations. These various input devices are described in an article by Lee (82).

Software (programs) continues to be a problem, not just for libraries but for everyone. The Government estimates that 50 per cent of its data processing costs are spent on software. High-level programming languages like FORTRAN, COBOL, and PL/1 have been useful to libraries, but they are not as efficient as assembly programs written for a specific computer configuration and specific library applications. On the other hand, unless the programmers have great expertise and the volume of library work is worth the time and effort, specialized programs can hardly be justified in terms of time and money.

There have been hundreds of articles about programs and programming, but only a few are of interest to librarians. An article by Avram and Droz describes the use of COBOL for MARC II (7), and one by Rather and Pennington describe the MARC Sort Program (119). Palmer has written an article about programming specifically for librarians entitled "Computer Programming for the Librarian" (108).

Regular computer printers are capable of printing in one type font and one type size, but more advanced printing equipment, often driven by a computer, is capable of producing printed material containing a number of different fonts and several sizes of type. A state-of-the-art report by Stevens and Little (142) describes automatic typesetting techniques, and an article by Duncan (44) discusses the typographical interface.

The inner workings of a computer are usually not of as much concern to librarians as the input and output units. However, a general idea of how computers work helps one to gain a better understanding and appreciation of computer technology. Furthermore, from all indications remote-access online devices will be used more and more in libraries, so that librarians should also have some understanding of time sharing. Most articles and reports about hardware are published outside the library field and related to business and industry but a few of a less technical nature are mentioned here: "Survey of IS & R Equipment" (Information storage and retrieval) by Berul (14), "Logical Design of Digital Computers" by Lindley (89), "Representing Characters to Computers" by Price (117), "Cost and Advantages of On-Line DP" by Brown (22), "Time-Shared Computing. Implications for Medical Libraries" (library-related) by Austin (5), "A Practical Look at On-Line Time Sharing" by Grubinger (54), "Some Problems with Time-Sharing" by Wilkinson (167), and "How to Prepare for Time-Sharing" by Ziegler (169). In addition, there are dozens of books on the introduction to computers and more are in process.

The September 1966 issue of Scientific American (132) is devoted entirely to information and its processing by computers. There are about a dozen separate articles in this issue, among which are ones on computer logic and memory, computer inputs and outputs, system analysis and programming, and time-sharing on computers.

Librarians and systems personnel involved in automation have some definite opinions and words of warning that are worth sharing regarding the necessary computer services. All agree that, if at all possible, at least one systems analyst and one programmer should be on the library staff, regardless of where the equipment is located. In a relatively small installation the analyst and programmer is often the same person.

Most agree that it is usually more satisfactory to have the original input--keypunching, paper-tape typewriting, or other keyboarding--done in the library. It is important in any case that the library be responsible for input production.

In selecting specific equipment from among various makes and types, the quality and promptness of maintenance service provided by the manufacturer is essential. Malfunctioning does happen and lost time can be costly. Provision must be made for a temporary back-up system to handle emergencies.

It should be quite clear that there is no single answer pertaining to equipment which will be satisfactory for every library. The University of Missouri Library and the Cuyahoga County Public Library have had success with their own computers. Some new libraries, such as the University of California, Irvine, have a voice in selecting equipment and operating the computer facilities. The majority at the present time are depending on services from a facility over which they have little control.

As with all of the other variables which make up an automated system, the choice and location of equipment depend very much on the local situation, but there are some important criteria to keep in mind when making the decisions:

> Assurance of high priority and quality service.
>
> A computer system with sufficient capabilities to handle the requirements of the library system.
>
> Costs within reasonable economic limits.

Improvements are continually being made in printing devices, storage devices, direct-access units, as well as in microforms and photocopy equipment, all of which are of interest to libraries. Becker's article, "New Technology of Interest to Libraries" (9) describes some of these, but librarians interested in equipment should make a practice of scanning current issues of computer journals for the newest developments.

5

G. Costs

Of the many considerations that must be given to an automated system, costs are perhaps the most difficult to analyze and discuss meaningfully. It is a topic that most everyone would like to avoid, and librarians in particular seem to have an aversion to money matters.

Nevertheless, the subject of money is included in most conversations about automation; and costs and sufficient funding are of major concern to libraries. Developing and designing an automated system is known to be expensive. Because of the extra time, money, and human talent required, most libraries cannot support design and development from their regular operating budgets and must seek additional funds from either regular sources or some outside agency. In the beginning the use of data processing equipment was heralded as the answer to improved library operations and carried the implication, if not so stated, that costs would be lower. At least this seemed to be the impression many librarians had; and when costs were not lower, they were disappointed. After the initial realization that automation in most cases does not reduce costs immediately, librarians seem more or less resigned to that fact and now talk of "economic feasibility," about which more will be said later.

One can look at costs in many ways--budgeted, actual, comparative, alternative, developmental, operating, processing, and finally economic feasibility. The discussion here is centered on budgeted, actual, comparative, and economic feasibility. Developmental and operating are included under actual costs. The comments made in regard to these costs are based on personal opinion plus factual information.

Writers constantly bemoan the lack of adequate measures for evaluating libraries and similar institutions. Libraries sell no product, they offer no saleable service, they have no profit motive, they are not so constructed that one can easily and meaningfully be compared with another, and yet the true extent of their value ought to be determined by combining qualitative with quantitative measurements.

Rather than bore any deeper into this dilemma for which the lament will surely continue, the purpose here is to give a few opinions about costs for whatever they are worth.

1. Budgeted Costs

A hypothetical budget is prepared something like this: This year expenses are X number of dollars. Income is negligible. If we expect to do about the same next year as this, we should increase the total 5-10 per cent because of inflation and because everyone expects a little more slaary. If we expect to do more than we are doing this year--increase accessions, employ more people, open a branch or two, purchase new equipment, or step up automation--then we estimate what that will cost and add it to the previous total.

In due course of time the budget must be presented to the proper authorities to be accepted, rejected, or revised down--never up. The interests of all in the library are, therefore, best served if we are careful to include everything. If the budget is accepted, we go on from there and spend what the budget indicates. If it is revised down, we do the same. If rejected, we begin again, cut back, and present a new one.

Some libraries must prepare budgets in a different way. They know before they begin how much they have to spend, and they must then allocate the funds as they think best. This fixed figure, determined by some higher authority, is affected by circumstances outside the library--whether the bond issue passed or failed, tax collections were up or down, the university finances are in good condition or not so good, company profits are better or worse than before, or the Government was generous or frugal.

Whichever way budgets are prepared, an approved library budget depends in the end on the value the higher authorities place on library services. The philanthropic era for most libraries is over. The library is now competing not so much with other libraries but with other agencies and operating units that drink from the same fountain.

The scramble for funds is now a matter of having to convince others that the library is worth as much as the budget requested, or to convince others in advance that the library is worth sufficient support. Those on the outside, whether patrons or authorities in charge of the money, know little about internal library operations and base their judgments on the services they receive, the general reputation of the library, reports from friends, their own personal opinions about all libraries, or other reasons. As a result, anyone with authority to act on library funding carries his impression of one library or all libraries into his decision-making role.

A few quotations from an article by Dr. Robert F. Munn, an administrator at West Virginia University, offer some clues about the future of library budgets (102). Although written for academic libraries, these views appear equally applicable to city, county, state, and in some cases special libraries. After making the statement that academic administrators think very little about the library, he continues:

> "One important consideration is the fact that many academic administrators view the library as a bottomless pit. They have observed that increased appropriations one year invariably result in still larger requests the next. More important, there do not appear to be even any theoretical limits to the library's needs. Certainly the library profession has been unable to define them. This the Administration finds most disquieting."

And later:

> "Since nobody yet appears to have the slightest idea how to make a cost-benefit analysis of the contribution of the library, few administrators feel justified in straying far from the traditional percentage."

And still later:

> "The current pressure to introduce modern management practices into the universities will not leave libraries unaffected. Such techniques as program budgeting require a much more rigorous analysis of the balance of return against investment than has ever been applied to libraries. Just why should the library receive 3 or 6 or 1 or 10 per cent of the institution's total budget?"

If these remarks are representative of the way higher authorities, e.g., university administrators or public officials, regard libraries, the message that libraries need improved management practices cannot be ignored by any librarian.

One of the least likely sources to look for assistance in better library management is the Department of Defense, but its relatively new Planning-Programming-Budgeting System (PPBS) has spread beyond the Federal Government to other governments, industrial firms, and universities. Some of the techniques are more complex than most libraries need, but the ideas and the rationale behind the system deserve the attention of library administrators.

Two articles discuss the need for program budgeting and cost analysis in libraries--"Program Budgeting and Cost Benefit Analysis in Libraries" by Keller (72), and "Program Planning and Budgeting Theory" by Fazar (48). According to Keller, the librarian is faced with unlimited objectives and limited resources; he will be increasingly required to put up "a more sophisticated and convincing analytical argument for his needs." He cannot afford to misspend the dollar and must be able to relate his costs to the benefits or effectiveness derived. Fazar gives some details about DoD's system, and both Keller and Fazar offer realistic suggestions for assisting library directors in their quest for funds.

For librarians interested in more details about PPBS, two reports from the Rand Corporation are suggested: "The Essentials of a PlanningProgram-Budgeting System" by DonVito (37) and "Program Budgeting and Executive Commitment" by Benton and Tenzer (13).

Most library budgets are made for one year at a time. Long-range planning and multi-year budgets are more in keeping with present economic developments, with the proper approach to automation wherever it is used, and with the attitude of administrators in general.

2. Actual Costs

Whereas budgeted costs are discussed in relation to the entire library system, the discussion of actual costs is confined to the costs incurred in connection with an automated system.

The actual costs incurred to design, test, and eventually implement any new system usually are of two kinds--developmental and operating. Developmental costs are essentially "start-up" and nonrecurring costs; operating costs begin as soon as the system becomes operational.

Unfortunately in an automated system this differentiation between the two costs often becomes obscure after the system is declared "operational." As the summaries of the different libraries have shown, computer-based systems are subject to change and require continuous monitoring. For example, new equipment is added to or replaces existing equipment; programs are modified to improve efficiency or because of changing equipment specifications; and new applications are added to the system, requiring that new programs be written to handle them.

Whether the costs incurred for changing or expanding a system are developmental or operating may or may not be important to a library. On the other hand a proper allocation would give a more accurate cost picture. If the changes are major, such as a different computer requiring extensive program modifications or the addition of a new application, e.g., circulation, more accurate cost figures will be derived by considering these as developmental costs. Perhaps the criterion should be based on how much the changes disrupt ongoing operations.

Although the differentiation is not always clear after operations have begun, it is fairly easy to identify developmental cost items before operations begin.

a. Developmental costs cover all the activities involved in making the analysis of the existing system and developing (designing, testing, and evaluating) the new system. Any one of the following activities or expense items can be considered a developmental cost:

(1) Gathering, analyzing, and evaluating data pertaining to the existing system, such as was discussed in part B. of this section.

(2) Determining those needs and objectives of the library which can be met by introducing a new system or modifying an existing system.

(3) Preparing flow charts at all levels to describe in graphic form the design of the new system.

(4) Selecting and installing the equipment or making arrangements to obtain service elsewhere.

(5) Writing and debugging programs.

(6) Designing formats for the records.

(7) Selecting and preparing input data for experimentation and testing, including any costs incurred to improve the reliability of present records.

(8) Designing special forms for the system.

(9) Use of all data processing equipment during debugging and testing.

(10) If possible, comparing the old system and the proposed system relative to costs, reliability, processing times, uses of professional manpower, etc.

(11) Conducting a pilot project.

(12) Developing a cost model and cost analysis studies (see below).

(13) Compiling data on test results.

(14) Converting the retrospective file to machine-readable form.

(15) Supplies, e.g., cards, printer paper, etc., used during development, as well as special supplies and furniture that the system requires, e.g., tub files, file drawers for cards, racks for tapes, etc.

(16) Retraining personnel and recruiting new personnel.

(17) Salaries of all personnel involved in developing the system.

(18) Writing new job descriptions and procedure manuals.

(19) Remodelling and/or equipping the building to house the equipment.

(20) Running the new system in parallel with the old until such time as the new replaces the old.

There may be others, but the list is sufficient to show that these are cost items incurred before and during the time the new system is being created. Often these costs are amortized over a period of years, e.g., three to five. If funds are provided specifically for development from some outside source such as a grant, it may not be necessary to amortize these expenses in the usual way.

A detailed discussion of this whole problem of costs appears in Fasana's article, "Determining the Cost of Library Automation" (47).

b. Cost Models and Cost Analysis Studies

These items have been singled out from the list of developmental costs for special attention since they are not discussed elsewhere in the report.

Anyone developing a new system would like to know what it will cost to operate. Estimates can be made but unless they are based on some facts, they are nothing but guesswork. During the period of development, techniques and procedures are constantly tried, tested, and evaluated so that wise decisions can be made for the eventual operating system.

As these different techniques and procedures are undergoing testing, it is possible to break down the processes into units or sub-operations for which unit costs can be derived. As the techniques and processes change, new unit costs can be computed and compared with the others. It is, therefore, possible to have a cost model for each combination of techniques and procedures, from which comparisons can be made to assist management in evaluating different methods and in making the necessary decisions.

The Library of Congress developed cost models for several phases of the MARC Pilot Project and reported the results in that project's final report (6, p. 67-76). The details involved in gathering data and the comparative costs for the different phases and time periods are of particular interest and value.

Cost analysis studies are made for much the same reason that cost models are developed--to get a reading on the best way to do something. Some studies are comparative, and some are made prior to the time work begins. Often cost analyses are part of much larger studies. Henderson and Rosenthal reported on the study made of the catalog of the New York Public Library to determine how it should be preserved and maintained (63). Maier reported an acquisition and cataloging cost study made of academic libraries in Colorado (91). Several years ago Hayes, et al. compared the costs of producing book catalogs by several methods (61).

c. Realistic Operating Costs

Accounting systems vary so much among different types of organizations and even organizations of the same type, that it is difficult to be specific about compiling operating costs; but some provision should be made to separate the direct costs from the overhead or indirect costs.

Direct costs are usually the day-to-day costs, such as salaries and fringe benefits, supplies, book and non-book materials, equipment, travel, etc., chargeable directly to a department, a group of departments, a process, a special purpose, or some similar identifiable breakdown. Overhead usually includes those continuing items shared by all, such as building rent or amortization, maintenance of the buidling, janitorial service, guards, heat, light, etc.

Cost information is rather scarce in library literature, but one gets the impression that there is a tendency to be unrealistic and to ignore certain items when attempting to compute costs of specific processes or suboperations.

Two areas in particular seem to be overlooked in cost studies. One is overhead and fringe benefits. Perhaps this is not the fault of persons compiling the data, for it may be common practice in libraries to omit these items in costing specific areas of operation. However, to get realistic total figures for a particular operation, some provision should be made for including the operation's share of the space occupied and the utilities used since charges of this type can add 10-30 per cent to direct costs. Fringe benefits now average as much as 10-15 per cent of the total payroll.

The second area where some libraries have tended to be naive is in the use of data processing equipment. In some institutions libraries have been given the "privilege" and even urged to use the computer free of charge or at a reduced rate. This has often been done to help the library get started, and it is an admirable gesture just so long as the library understands that eventually it will be charged regularly for these services. More than one library director has been shocked to learn that free time is no longer forthcoming and has been handicapped by not anticipating this possibility. Those who are more knowledgeable in matters of costing realize that someone is paying for computer time and eventually it will be the library. They have very wisely kept cost records of uncharged machine time and have included these figures in making cost estimates to obtain realistic operating figures. The changeover for them offers no surprises.

A realistic approach to itemizing costs--all costs--gives management much more accurate data with which to work. Once a budget is approved, expenditures are expected to stay within the budgeted amount. The question to be answered is "How much can be done with what is available?" Libraries have no trouble spending what is allotted but there is a strong suspicion that not all libraries make enough effort to find out whether the funds are being spent wisely to yield the results intended. With the pressure of competition for funds, the need for better regulation and control of expenditures becomes greater than ever before.

Cost studies of different kinds have been made in libraries, but they are not in great number. Black (16), Hammer (59), and

Chapin (26) reported on studies made in their own institutions. For the economy-minded, Atwood and Livingston's article, "Automation on Ten Dollars a Day," should be of interest (4).

3. Comparative Costs

Costs can be compared in several ways such as comparing the new (maybe automated) system with the old (maybe manual) system within a library; or comparing one library's system with the system in another library. One can also compare costs of different phases during development of a new system as was explained above. To make a comparison assumes the presence of characteristics common to both, and therefore a comparative study has limitations. This is particularly true when attempting to make cost comparisons between the old and the new or between systems in two different libraries.

a. Comparing Systems within a Library

Those involved in automation are anxious to compare automated applications with previous methods but are finding it difficult. At least two problems are often encountered when trying to make such a comparison.

First is the lack of complete records for manual systems. Aside from the fact that they are accused of keeping poor records, libraries traditionally have not kept the types of records that lend themselves to comparison with automated applications. Maintaining performance records, time records, or cost records of specific jobs does not seem to be a common practice in most libraries. Even when records are kept, they are often compiled in different ways or include different items for costing. The lack of standardization in gathering cost data has resulted in the necessity for each library to determine for itself how operational studies will be conducted.

A second problem is that even the best records kept for a manual system do not correlate well with an automated system. Records for manual and automated systems are created in different ways. In manual systems a record is usually created by one department for use within that department. Each department maintains its records to fit its needs and in the way it considers best; and the methods used to compile the data may differ among the departments. An automated record is created once with the idea that it will be used many times for many different purposes and in more than one place or department. A book card created for a manual system is fairly easy to cost, but the cost of a book card created as a by-product of acquisitions or cataloging is more difficult to separate from the total.

Unless all of the procedures comprising each system are considered, or unless the replacement of the manual with the automated is an exact one-to-one relationship, a comparison of costs may be unrealistic. Even at best the results of comparing manual and automated procedures are somewhat less than satisfactory.

Assume, for example, a hypothetical automated system that includes the acquisition and complete processing of books from the time they are selected for ordering until they are shelved and ready for circulation. In this system as soon as anything is known about a title, it is put into machine-readable form and stored on magnetic tape. The record for each title is updated as soon as its status changes so that by the time the book is completely processed and ready for shelving, the bibliographic information is complete.

Among the products that can be generated are purchase orders, catalog cards, shelf list cards, book cards, book catalogs, spine labels, book pockets, and numerous lists. In a manual system some of these products would have been charged to acquisitions, some to cataloging, and some to circulation. In an automated system several items may be produced simultaneously, and all are made from the same machine-readable data base. The interrelationships that exist in an automated system, unless it is one lone application, make it difficult to break down the costs for a single product or process because each product or process is no longer independent.

If cost data for all processes are available in the manual system, the best comparison to make would be the total cost of all steps in the manual (or former) system versus the total cost for producing the same results and/or products in the automated (new) system. This approach comes closer to comparing like with like, but even this does not tell all that one would like to know. It does not give a clue whether service to patrons has improved or whether the professional staff is used more efficiently. It does not recognize any additional products produced or give any kind of qualitative evaluation. Nor does the comparison tell how costs will be affected by an increase in the volume of materials to be handled. Some of the difficulties in attempting to compare systems are mentioned in Fasana's article referred to earlier.

All comparative studies have limited value; a single comparative study has even less value, especially in relation to costs. To be of help in planning for the future, each study should be followed up periodically by other similar studies to indicate changes and trends.

Those who have published cost studies admit to gaps in cost items and shortcomings in the reporting. Nevertheless, these studies make a worthwhile contribution by pointing out the problems inherent in making studies of this type.

b. Comparing Library Systems

It is human nature to like to know what the other fellow is doing; and libraries are interested in knowing what other libraries are doing, especially if they are of the same type and size and appear to have similar characteristics. A library director might consider published accounts of actual costs of other library systems as one means of evaluating his own system.

Because this subject always generates interest, from time to time the absence of actual (and, therefore, presumed useful) cost data in the published literature is regretted. This report takes the position that it would do very little good for Library A to know what it costs Library B, and it would do nothing positive for Library B.

For many of the same reasons that one library cannot borrow in toto a system developed in another library (see part H. of this Section), one library will not find it very fruitful to compare its dollar costs with another. At the risk of belaboring a point, we must remind ourselves that each library system is made up of a number of basic components and each component is a variable. Rarely would two library systems be identical in every way--budgets, collections, facilities, payrolls, or reporting methods. To attempt to make a dollar comparison would do little more than satisfy the curiosity of Library A, and it would be of no help to Library B.

Dollar costs tell practically nothing about the quality of a library and very little about the efficiency of its operations; only how much money was spent and in what expense categories. Of more value to other libraries for comparative purposes would be the type of reporting that details the cost items included and then expresses them in percentages of total expenditures, with or without dollar amounts. By showing that certain procedural changes enabled a library to reduce its personnel costs from A per cent to B per cent and to increase its funds for materials from X per cent to Y per cent would provide a better means for comparison with another library than if these changes were expressed in dollar amounts only. Dollar amounts have value in showing the magnitude of the operation, but for comparative purposes percentages show the degree of change.

Some of the problems encountered in making a comparative cost study are reported by Dougherty in "Cost Analysis Studies in Libraries: Is There a Basis for Comparison?" (39).

4. Economic Feasibility

Everyone has a vague notion about what is meant by "economic feasibility;" but when applied to libraries, "economic feasibility" runs head on into the problem of determining the value of a library in both qualitative and quantitative terms.

If a new automated system costs little more than the old system and provides at least as satisfactory results, it would probably be declared "economically feasible" because one would expect continuing improvements in service.

But, if a new automated system costs twice as much as the old system with no immediate improvement in service, most librarians would consider the system not "economically feasible." On the other hand, the fruits of today's efforts may not be fully realized for as much as five years; so, before discarding a system, its potential for achieving economic feasibility should be evaluated.

Because the costs incurred in developing some systems have been tremendous, often exceeding the original estimate by a substantial amount, one may question whether automation is really worth the trouble. In fact two questions seem appropriate to consider in connection with costs and economic feasibility: whether automation is the course to pursue in improving library operations and services, and whether the experimentation, testing, and implementation thus far have been of value.

This report has taken the position from the beginning that automation is the course to pursue for improving library operations and services, even though many problems have yet to be solved. One important cost consideration for long-term planning of automated systems is the direction that different kinds of costs appear to be taking, both in the general economy and in libraries.

Throughout the economy salaries and wages are rising faster than any other expense item. Unfortunately salary increases alone do not guarantee comparable increases in the productivity of individuals, so that the employer is often paying more for essentially the same amount of effort. Business can increase prices to offset any extra expense, but libraries cannot. The only recourse for libraries is to devise ways to increase staff productivity, which is suggested by Kilgour in "The Economic Goal of Library Automation" (76).

While personnel costs are increasing, machine costs are coming down. Computers and their peripheral equipment are not only being improved and refined, but ways are being found to reduce prices. This is true not only of computers and related devices but also of photocopy and microfilm equipment. One has only to recall the history of such everyday conveniences as the telephone, radio, television, and automobile and to follow the short history of the computer to realize that the trend is upward in volume and downward in price, and usually for greatly improved products.

Another expense item increasing rapidly is the cost of books, journals, and other materials which make up the collection. Not only are the number of items acquired by libraries adding to the total costs, but the cost per item is rising. Here it becomes a matter of careful selection based on need, use, and other criteria that determine selection policy. Automation can play its part by providing quantitative data to assist in materials selection.

At this time the alternative to using automation for certain tasks is to use manual methods. As Fasana points out, an increase in volume of materials processed by people rather than machines results most often in a proportionate increase in salary costs. On the other hand, as the volume of work processed by machines increases, the unit cost of processing decreases since many machine costs remain fairly constant, e.g., rentals and overhead.

Even those who are not very enthusiastic about automation admit that, assuming no more than the present rate of growth, many libraries will not be able to handle their day-to-day processing by manual methods and will be forced to look for alternatives.

This report also takes the position that the high cost of development has been of value. Planning, experimentation, testing, and evaluation are an unavoidable part of any carefully thought-out new endeavor. At some time and in some place these steps must be taken; if they are not, nothing but chaos and even greater expense are in sight. There has been waste and undoubtedly there has been a certain amount of "reinvention of the wheel" while automation in libraries has been getting underway; but much of this has been unavoidable. In the absence of guidelines and a body of knowledge to lend support, libraries have had to engage in "trial and error." Experimentation and the use of new techniques take longer than established procedures and inevitably increase costs. As communication improves and criteria are developed, hopefully more will be learned from the experience of others.

It does not seem fair to attempt to determine economic feasibility (even quantitatively) early in the operating life of a new system. Most automated operations have not existed long enough to be evaluated. Bench marks, however, can be established to judge the progress and alter the course if necessary. Existing systems or subsystems that are operating should attain some degree of stability before an effort is made to determine "economic feasibility."

For the past fifteen years researchers and practitioners in information retrieval have also been struggling with the problems of costs and the determination of economic feasibility. There have been theoretical, hypothetical, and mathematical studies as well as a few reports on actual installations; but it is still a neglected area in the literature. In some ways cost analysis is easier for an information center than for a library because the operations and services are not so diffused. But they too recognize that the ultimate criterion of success is the satisfaction of user needs and that the ultimate determination of economic efficiency is dependent on how accurately user needs are identified.

Economic feasibility is a recognized goal for automated library systems, but some satisfactory means must be found to base it on a combination of quantitative and qualitative values.

H. Outside Assistance

From time to time libraries engaged in automation would like to seek the advice of "experts" or utilize some of the plans, materials, computer programs, etc. already available in another library and are undecided whether either is expedient.

Libraries do employ outside consultants and contractors, and they do attempt to adopt or modify an existing system, but there are no definite criteria to assist in making decisions. Bibliographies, directories, and the experiences of others lend assistance but very limited bases for critical evaluation. A few libraries, such as the libraries of the University of California and the University of Missouri, are fortunate to have the assistance of special groups affiliated with the library schools; but these are the exception. Other libraries, for the most part, must rely on common sense and a feeling for their own needs and problems.

The purpose here is neither to condemn nor praise the use of outside assistance but to point out some of the considerations prerequisite to effective decision making.

1. Consultants and/or Contractors

In this day and age of rapid changes, computer technology, and government subsidies, one of the fastest growing and quite lucrative activities for anyone with even brief experience in a given field is to become a consultant. To join the ranks of consultants apparently requires no more credentials than the act of hanging out a shingle and/or making an announcement to that effect. This move seems to be enough to become an "expert" and to have one's name added to the roles of those qualified to provide professional advice and service.

As a result, there has been wholesale acceptance of these people even though they range from excellent to very poor and from those who understand what they are doing and expect to fulfill their responsibilities to those who are more interested in the dollar than in their clients. Library consultants are no exception.

Consulting work has become big business and is much in need of an overhaul. One article states that data processing consultants are being paid over $500 million a year. Add to this all other types of consultants peddling their "expertise" and the figure could approach one billion dollars--quite a tidy sum for advice and guidance for which there are no established standards by which to grade quality except the reputations of the consultants and/or their abilities to sell their services.

This is not to say that there is no place for consultants. There certainly is a need, or there would not be so many clammering to get into the business and so many eager for their services. There are many excellent consultants and consulting firms in this country that have been providing much needed services for years, but the forest is also occupied by just enough of those not so capable that libraries and others should exercise caution before making firm commitments.

Because of the lack of certification to establish consultants' qualifications together with a certain credulity on the part of librarians, the experiences among libraries range from great success to the verge of disaster. Dissatisfaction is caused by such factors as lack of understanding of libraries and their problems, too much division of responsibility, too much buck passing, little attempt to keep to a schedule, poor products, and lack of interest. Some of these factors are probably the result of incompetent consultants, but others may be because of a lack of understanding on both sides regarding the responsibilities of each--the library and the consultant.

A consultant may be employed for any one of a number of reasons. For an automation project the library director may decide that his present professional staff does not have the time and/or the expertise needed to get the program underway. Or he may feel that the professional staff is competent to handle the work but a consultant can offer much needed advice. Some libraries have used consultants to make special studies, to identify problems and offer solutions, or to appear periodically to lend assistance, reassurance, and guidance regarding ongoing projects. These are legitimate reasons for having a consultant.

There are some identifiable responsibilities on both sides; and if these are recognized, they tend to make the working relationship more rewarding.

In fairness to any consultant, he should, if at all possible, be brought in early to participate in planning and developmental activities. He should not be expected to wait until things have degenerated into such chaos that a genius would be required to extricate the project. He deserves to be given the necessary records, tools, and background information as well as the cooperation of the staff. A good consultant can be badly managed, and even the best cannot produce quality work if he must proceed blindly.

During the negotiations there should be a clear understanding between the consultant and the library regarding financial arrangements, the time schedule, and what the library expects him to do (if there are major changes made at any time, renegotiation may be necessary). The most successful use of consultants seems to be in those organizations where the consultant and the organization have worked out a long-time relationship, which provides the opportunity to develop mutual trust and understanding.

A consultant, however, should not be employed to identify goals and objectives that are clearly the responsibility of the library. Nor should he be expected to assume duties or make decisions that normally belong to the director or members of the staff. He should not be a substitute for the staff nor employed for disciplinary purposes.

For his part, the consultant is expected to offer competent and high-level professional opinions that have been gained through experience. His reports should be given objectively--telling both the good and the bad. He is expected to have the ability to identify the problems _and also_ to find solutions. Many consultants fail to do the latter. He should have integrity, loyalty, empathy, and an appreciation and understanding of the organization he is to serve.

Some libraries use outside contractors. The distinction between their services and those of consulting groups is not always clear. A contractor often brings in his own staff to perform work such as systems analysis, programming, etc. and may also act as a consultant. Some consulting groups provide these same services. Regardless of whether the library uses consultants or contractors, the same criteria apply for selection and delegation of responsibilities.

2. Adopting or Modifying an Existing System

Because automation is costly and requires time and money for extensive development, libraries may be interested in the possibility of borrowing or adapting ongoing systems developed elsewhere. When a library sets out to design its own system, it understandably makes every effort to custom tailor the system to meet its own needs, its own constraints, and its own characteristics. The question then arises whether it is possible to borrow another's system.

Experience has shown that it is possible to adapt and/or modify another system, but it is rarely possible to adopt another system _in toto_. In no case can a system be transferred from one library to another without difficulties, or at best without major revisions.

By this time it should be fairly clear that the differences existing among libraries are factors to be reckoned with in developing automated systems. All libraries are made up of essentially the same basic components which can be put together in different ways. The results obtained when combining these components are what distinguish Library A from Library B, even though the two may appear to be very much alike.

Suppose, for example, that Library A has a successful, operational, computer-based serials system which Library B, with a comparable serials collection and similar computer capabilities, would like to adopt. For Library B to adopt the system without making any changes would require that the two libraries have virtually identical operations, such as the same entry format, punctuation, call numbers, and filing rules and the same equipment configuration. It would also mean that the programs prepared in Library A could be used without change in Library B. Obviously, this type of situation is rare.

If the practices in the two libraries are not identical, then Library B must consider some alternative, perhaps modifying and adapting to its own specifications the system of Library A. The degree to which this is possible depends on the amount of similarity between the two libraries.

One of the most complete accounts of such an experience is given in a report by Dougherty and Stephens, "Investigation Concerning the Modification of the University of Illinois Computerized Serials Book Catalog to Achieve an Operative System at the University of Colorado Libraries" (41). The report details many of their problems, the kinds which might be encountered by others who plan a similar undertaking. In capturing the data from the Illinois tapes, Colorado found that the main entry forms were not always the same, filing rules differed, serials cataloging differed, and there was much less overlap of titles than anticipated. Colorado concludes that program documentation (description) is much more useful than the actual programs and that standardization of bibliographic systems is essential to an efficient exchange of bibliographic data. In addition, the report emphasizes, as others have, the importance of preliminary planning and active library staff participation in the planning.

When one realizes that the above project was concerned only with a holdings list and not with the more difficult processes such as check in of issues, binding, claiming, etc., it is easy to understand that, at the present time, it is almost impossible to adopt another system without modification.

It is possible, of course, to use a skeleton plan and the general ideas of another system. The IBM 357 circulation idea is used with variations in many libraries. The "arrival card" for check in of serials, developed at the University of California, San Diego, is used by other libraries. But in most cases some adjustments have had to be made to satisfy local requirements.

Some of the new systems under development are being designed with more flexibility and provisions for options and alternatives, without regard to hardware or software. Individual libraries throughout the University of California system are developing subsystems, e.g., one is working on serials, one on acquisitions, etc., which, it is hoped, can be adopted by the libraries on other campuses. Several of the libraries whose activities are summarized in Section IV are developing their systems with the idea that they can be used elsewhere.

The Library of Congress has gone even further with MARC II and has designed a format which will be hospitable to all kinds of records and different equipment configurations. The trend is away from rigidity toward designs that are flexible enough to offer choices and that are not wedded to specific kinds of hardware and software. Nevertheless, the exchange of data bases and optimum utilization of computer technology will never be completely satisfactory until librarians are able to agree on much more standardization than now exists.

I. Library Operations

The over-all purpose of having automation in a library is to make improvements that will, directly or indirectly, benefit the patrons. Some of these improvements such as acquisitions may not be evident to the public; but others--catalog maintenance, circulation, holdings lists, and reference services--affect the patrons directly when they use the library.

The two singled out for special consideration here are the bibliographic apparatus (the catalog) and its relation to reference services, and circulation.

1. Constructing, Maintaining, and Using the Bibliographic Apparatus

Even the critics of some present-day cataloging practices recognize that a library must have some system of bibliographic organization and control in order to give proper service and to remain a viable institution. There has never been complete agreement, however, on just how this should be accomplished. Because the bibliographic apparatus is viewed as the heart of the library, the details of its implementation are from time to time both attacked and defended. Much of this controversy in the past could be little more than an academic exercise because the catalog in most libraries appeared in reasonably standard form (a catalog card using the contents of an LC card or a slight modification).

The introduction of automation has given substance to this controversy and has succeeded in renewing interest in two seemingly eternal questions affecting the catalog: (a) What should the bibliographic record include? and (b) In what form should it be made available? Within (b), consideration is given to the card catalog, the machine-readable catalog, and the book catalog. File organization is discussed in connection with machine-readable catalogs and filing rules along with book catalogs.

a. What Should the Bibliographic Record Include?

Over the years there have always been those who support John Cotton Dana's belief that the purpose of a catalog entry is to minister to finding needs and that finding needs can be satisfied with one-line entries, e.g., call number, short author, short title, year.

At the other extreme are those who believe that a catalog card should be a masterpiece of detail and aesthetic interest. It is obvious which side won, for a printed catalog card is now something of a masterpiece.

When the Library of Congress began producing catalog cards early in this century, the contents of the cards became fairly well standardized. All who have used them have accepted these contents as the line of least resistance. Although Dana's followers might prefer a shorter form, the extra effort required to extract the data has never been worth the time and cost. As a result, the question of what to include has not been a practical subject for discussion for some years.

Automation, however, provides the capability to satisfy both groups--to have available complete and detailed bibliographic data for those who need all of the details, and also to provide the finding list type of entry for others. The work at the Library of Congress in connection with the MARC Project provides this capability.

In 1965 and 1966 the Library of Congress held several conferences with catalogers and other librarians to decide what should be included in a machine-readable catalog. The natural tendency has been toward completeness for a machine-readable data base, and that is what happened. The librarians decided not only to retain everything that now appears on a printed catalog card, but also to include explicit bits of information that the user now recognizes implicitly, e.g., language. From these discussions the MARC I format was developed and tested; as a result of the testing and additional discussions, some changes were made and the MARC II format became a reality. Those responsible for making the decisions were wise to adopt an extensive and inclusive format.

The library's bibliographic records exist for the use of both patrons and the library staff, but bits of information important to the staff are not necessarily of interest to patrons. Only recently has any serious attempt been made to learn how much of the detail on a catalog card patrons ordinarily use. The Library School of the University of Chicago (153) and the Research Staff of Yale University Library are exploring this question. The results obtained will probably have little effect on the content of catalog cards, but they could affect the production of book-form catalogs.

For the first time it has become practical to include "everything" in machine-readable form and extract only what is needed for a specific purpose. And perhaps for the first time in history the question of what to include at any given time can now be resolved.

b. In What Form?

The bibliographic records of libraries are now available on printed cards, in machine-readable form, and in printed book form. Since each deserves special attention, each is discussed separately and in the order listed above. Although the book catalog antedates both machine-readable and card catalogs, it is put in third position because the kind discussed here emanates from a machine-readable data base.

(1) The Card Catalog

The card catalog, as long as it exists, will probably be least affected by automation. There seems to be no movement underway to change the contents of the catalog card. Libraries will continue to use printed cards and/or produce their own.

Those with access to data processing equipment can produce cards on a computer printer or tabulating equipment. All tab equipment printers and the majority of computer printers have upper case letters only and a very limited number of punctuation marks and other symbols. A number of libraries, as indicated in Section IV, find the upper case, limited character set satisfactory for their needs. Other libraries cannot accept such a limited character set and must either locate a printer with upper/lower case capability and adequate punctuation or use other means to produce the cards, e.g., photocopying or duplicating LC proof sheets or typed copy.

The card catalog, as librarians are quick to point out, has many advantages and has been an effective instrument for maintaining bibliographic control over a long period of time. Understandably, libraries are reluctant to give up what has served them so well. But the dictionary card catalog, once thought to be an instrument without equal for library management, is now rapidly losing its usefulness in many large libraries. Sheer size, deterioration of cards, and complicated filing rules have become frustrating to both users, many of whom have never understood how cards are filed, and the library staff, who also either may not understand the rules or are annoyed by misfiled cards throughout the catalog.

A study made of the public catalog of the New York Public Library showed that about one third or over two million cards were unreadable because of faded print, missing call numbers, and other damage caused by age and continued use. The Library of Congress and most of the other old and large libraries are experiencing similar problems.

Criticism could be directed to those librarians of the past for neglecting the catalogs, but that would be without profit. Today's librarians who inherited these monsters are looking for ways to improve them. New York Public has continued the study of its catalog (63), and the Library of Congress is working on many aspects of its bibliographic problems.

Numerous suggestions have been made for dealing with the large dictionary card catalogs such as:

- Dividing the present catalog into Author, Title, and Subject sections; or into Subject and Author-Title.

- Cutting off additions to the present catalog and beginning a new one.

- Putting the older materials in book form (with a certain cut-off date) and maintaining a card catalog for recent materials.

- Vice versa--keeping the card catalog for older materials and maintaining book-form catalogs for recent materials.

These are viewed as possible short-term solutions. For the long-term solution librarians must be thinking of machine-stored catalog data and the possibility of having the data accessible to the library staff and the user by some remote means.

(2) The Machine-Readable Catalog

Those libraries that now have catalog data in machine-readable form are for the most part using the information to produce catalog cards or book catalogs. Most libraries cannot, at the present time, serve the user directly in any other way except by providing printed cards or pages.

Hopefully use of such a powerful tool, i.e., machine-readable bibliographic records, will be expanded to provide other services. Libraries in good conscience cannot justify forever the expenditure of vast sums of money and thousands upon thousands of hours of human effort to do nothing with the accumulated data except make catalog cards or pages. The potential for improvement in service to patrons directly as well as to staff members in acquisitions, cataloging, and last but by no means least, in reference services is practically unlimited and much too great not to be exploited to the fullest.

With due recognition of the fact that complete catalogs in machine-readable form are more in the future than in the present for most libraries, the concern here is the use of records in machine-readable form.

It is generally recognized that, for adequate exploitation of such records, online access to the computer must be available to the user, whether he is a library patron or a staff member. Online access requires random storage devices, such as magnetic disks, drums, or cells, for storing the records and some device, such as a typewriter or CRT, connected to the computer to gain access to the stored records.

An important consideration for discussion in connection with direct access to machine-stored records or files is FILE ORGANIZATION--how best to organize the records for maximum utilization.

Maximum utilization must provide the user with something more than he now has in a card or book catalog but within reasonable cost limits and levels of efficiency. The user will not be interested in using a machine-stored file unless results can be obtained faster and with no more effort than he now exerts to use a card or a book catalog. The library will want the records stored in such a way that a user can get satisfactory results in the shortest possible time but at moderate cost to the library.

The manner in which the bibliographic records are organized with the combined use of random storage, e.g., discs, and sequential storage, e.g., magnetic tapes, determines the effectiveness and efficiency of searching the records. In order to accomplish a satisfactory effectiveness/efficiency ratio, a machine-readable catalog must be more than simply a carbon copy of a card catalog--dictionary or divided.

Let us look for a moment at a card catalog. It can be approached by author(s), title, and several subjects--representing an average of perhaps five or six access points for each title. This means there are five or six identical cards in the catalog, so the same information about a title is repeated that many times. Even a novice in computer technology can recognize at once the extravagance of such organization of data for a machine. Rather than have identical data stored five or six times for each title, the complete record needs to be stored only once and by the use of additional machine-stored indexes the complete record is accessible to the user. The ease with which computers can manipulate data in this fashion suggests that future bibliographic records may include more index terms or subject headings as well as other access points such as are represented by the tags given the MARC records. Deep indexing and additional access points for searching the literature are already features incorporated in the automated search systems of some information centers and special libraries.

This report cannot give this very important topic the attention it deserves, but Warheit's article, "File Organization of Library Records" (156) is recommended reading for all who wish a nontechnical and clear explanation of various types of file organization and storage of records.

A further concern of librarians is the unreliable or incomplete information that patrons have in hand when they consult the catalog. Knowing the preciseness that computers require and the habits of their patrons, which cannot be expected to change appreciably in the future, a number of writers have addressed themselves to this and related problems. Richmond recognized these problems some years ago (123, 124, 126). Ruecking (127) and Nugent (106) have reported on their work in this connection.

The question of organizing files has, of course, occupied the minds of all engaged in storing large quantities of records, e.g., Social Security, ever since computers came into use. One of the early discussions relating to libraries occurred at the Airlie Conference in 1963 (93 , Sections II and III). One of the first to provide insight into man-machine communication in libraries and what is in store for the future is Licklider's well-known and frequently cited book, Libraries of the Future (88), which has been cussed and discussed by librarians over the years. In 1967 a seminar was held in England to discuss the organization and handling of bibliographic records by computer (30), and a recent article by Grosch discusses the implications of online systems techniques (53).

As more bibliographic records become available in machine-readable form and as online access becomes a reality in more libraries, the question of file organization and access becomes more serious. Librarians, more than any other group, know catalogs and the problems patrons have in using them. It is hoped they will transmit this knowledge willingly to those who must handle the technical responsibilities of file organization and access methods.

(3) The Book-form Catalog

In spite of the fact that book-form catalogs have not been practical to produce since card catalogs proved more efficient, the subject of book catalogs has always been of interest to librarians and scholars who like the idea of scanning a page rather than sorting through cards. Now that automation is here, book catalogs have become somewhat controversial. Some consider them a fad, but others favor replacing card catalogs with book catalogs as soon as possible. Probably the majority think of the book catalog as a supplement rather than a replacement or substitute for the revered dictionary card catalog.

This is not the place to continue the argument. Concern here is with some of the details that must be resolved when a book catalog is produced by computer or tabulating equipment. The details of particular interest are the content of the catalog (what to include); the filing arrangement; the method of production; and the coverage and frequency of producing single supplements, cumulative supplements, and Master copies.

Each library producing a book catalog seems to make its own decisions regarding the completeness of the contents. Some produce only finding lists (one-line entries); some, abbreviated contents containing more than one line for each entry; and others, the complete bibliographic record. Some, like the Washington State Library (see IV.B.), produce the catalog in four parts--a "Register" in accession number order containing the complete bibliographic record, and shorter entries in the author, title, and subject sections.

Most book catalogs are divided into author, title, and subject sections or author-title and subject. A few are further divided into fiction and nonfiction, and adult and juvenile.

Printing out the catalog is one of the big computer expenses. Printers operate at so many lines a minute, e.g., 1,200, and computer charges are usually based on an hourly rate. If a library can satisfy the great majority of patrons with a simple finding list, printing costs could be greatly reduced. For example, a four-line entry costs almost twice as much to print as a two-line entry. Those few users who require more details could be invited to use the library's files that contain the complete bibliographic record for each document.

The second concern, filing arrangement, has been a real headache for libraries trying to follow the ordinary library filing rules when producing catalogs by machine. As far as is known, no library is attempting to use the dictionary catalog filing rules or produce a dictionary book catalog. One of the reasons must certainly be the complicated filing arrangement. Dictionary catalogs have not been proved that much superior to divided catalogs to warrant the tremendous expenditure involved in writing programs and coding the input for dictionary arrangement.

Some work has been done at the Library of Congress and by others on dictionary catalog file arrangement, but someone will certainly have to convince many people of its superiority before an expenditure to produce a dictionary book catalog by computer can be justified.

Just to follow the ordinary library filing rules is bad enough. Computers cannot handle "implicit" information without some specific instructions. "As if" entries, omissions, and rearrangement of words for filing purposes require special handling. Punctuation marks can also affect the order of entries so they are not compatible with library filing rules. Hines and Harris (65), and others offer suggestions. Perhaps filing rules have become too much of a fetish--many think they have. At any rate the possibility of simplifying and revising filing rules without sacrificing the "integrity" of the file or without losing most of what librarians think is gained by complicated filing rules should be an area for serious study.

The third consideration, method of production, includes several factors: tabulating equipment versus computer; upper case only with very limited punctuation and symbols versus upper and lower case with adequate punctuation and symbols; format arrangement--one, two, or three columns; print reduction and page size; method of producing necessary copies; quality of paper; and binding.

Tabulating equipment, printing at the rate of 150 lines a minute, costs perhaps $15-$20 an hour. Computer printers, printing at 600-1,200 lines a minute, cost from fifty to hundreds of dollars an hour. Therefore, unless computer charges exceed $150 an hour, the computer is more economical and results in a great saving in time. Furthermore, tabulating equipment has only upper case letters. Some computer printers have both upper and lower.

Upper case versus upper/lower case is of interest to libraries from the standpoint of readability and appearance and also punctuation marks and symbols. Printers with upper case only usually have from eleven to twenty-five symbols, including punctuation marks. On some printers the semicolon, colon, quotation marks, question mark, apostrophe, and the like are not available. Some libraries have refused to use the upper-case character set, but others report little dissatisfaction from users.

At the present time printers are constructed so that the upper/lower case print chain reduces the printing speed about half, which roughly doubles the cost; but the improvement in appearance and readability outweighs the extra expense.

Weinstein (160) has suggested a method that may be of interest to small- and medium-sized libraries. Input data is prepared on a paper-tape typewriter in upper/lower case format. The data can be stored on magnetic tape for other uses; but whenever an upper/lower case printout is desired, e.g., book catalog, the typewriter is used. This process is very much slower but very much less expensive.

Most libraries would probably find an upper/lower case print chain with adequate punctuation satisfactory, but very large libraries should have character sets large enough to include diacritical marks, Romanized characters of non-Roman alphabets, and in some cases actual characters of non-Roman alphabets to handle foreign languages. The United States of America Standards Institute is developing an expanded standard set of characters that will handle the requirements of large libraries. The study of characters made at the Library of Congress preliminary to determining its needs was reported by Rather (120).

Computer-driven printers are also available to print in different fonts and sizes, e.g., Photon and Linotron, but the cost per page is high and the majority of libraries do not require this level of printing.

The format or arrangement of entries on the page can determine the total number of pages. One column, with one entry extending across the entire page, is the least expensive and the least attractive. The use of two columns increases pages but improves the appearance; three columns are the most expensive and require the most pages.

The cost of producing a book catalog does not end when the computer has finished printing. Anyone familiar with computer printouts knows that the paper is oversize and flimsy and the printing is large. If one wants a catalog with lots of paper, one column, and not much print on each page, multilith masters instead of paper can be used for printing and then run off on a duplicating machine. Most libraries have the print photo-reduced so that more entries can be placed on one page and so that a multi-column arrangement can be used. The result is much more attractive but the photo-reduction adds to the cost.

If the catalog is to be available for public use, the quality of the paper and the binding must be durable enough to last its service life, which may be weeks, months, or years.

The fourth major consideration is the coverage and the frequency of publication. Coverage usually relates to time--whether the book catalog will include the entire collection, the collection beginning with imprint dates a certain number of years back, e.g., ten years, or current acquisitions only. Any program but complete conversion necessitates retaining the present public catalog.

There is no established pattern to follow regarding frequency of publication. Since the catalog is out of date before it reaches patrons, some provision must be made to notify them of recent accessions. Noncumulative supplements are less expensive than cumulative but may require the patron to look in more than one volume. Each printout adds to the cost, but, of course, the less frequent the supplements the more difficult it is for patrons. The great expense comes in incorporating supplements into the MASTER catalog. Issuing Master Catalogs to cover five- or ten-year periods and beginning anew at the end of that time is one way to reduce the expense, although this practice diffuses the bibliographic records.

The above are just a few of the details libraries must think about in connection with book catalogs. Large systems with branches or groups of libraries have used book catalogs with great success. Book catalogs can give all patrons access to the collection of the entire system when it would not be economically feasible to install a complete card catalog in each branch. Los Angeles County, Baltimore County, Washington State Library, King County, Washington, and others can now provide access to their collections by this means.

The book catalogs of Stanford Undergraduate Library, the Medical Library of Washington University, and the Medical Library of the University of New Mexico are examples of the use of book catalogs in academic environments. Special libraries have also used book catalogs in branches and departments located some distance away.

One advantage ascribed to book catalogs in academic and special libraries is the possibility of providing a set of catalogs to each department or even to individuals, the assumption being that everyone would like this service. A number of librarians who have tried to provide such a service report that departments and individuals have not been especially enthusiastic about having a book catalog readily available. This may not be true in all cases, but Brodman reports just such an experience (21). Such response shows once again how little we know about library patrons.

Whether or not book catalogs can provide some of the necessary solutions to the problems of maintaining an effective and efficient bibliographic apparatus remains to be tested more fully.

The conversion of bibliographic records to machine-readable form (see also F. in this Section) is, of course, a tremendous undertaking for libraries; therefore, no one is predicting the rapid disappearance of card catalogs. But, as has been said so often in various ways, libraries will have increasing difficulty in managing their records and exploiting their great resources without machine-readable data bases.

Small- and medium-sized libraries find conversion easier than the very large, but the very large are in greatest need of conversion. Libraries serving research and scholarly needs cannot be satisfied with converting only current materials, because their present collection, often dating back centuries, is equally important. Large libraries with millions of documents and more millions of records face a job representing years of work. Some libraries are converting their shelf lists; Harvard, for example, is converting its sheaf shelf list, taking several classes at a time.

There are several ways to convert records; but none is fast, easy, or inexpensive. It is too soon to predict what effect the RECON project will have on other libraries, but a combination of RECON and MARC should offer more than token assistance. Improvement in the technology and the possibility of lower costs for online devices are encouraging. Cooperation among libraries could serve all to advantage.

No one can argue against a library having somewhere in its files a complete record of every item it holds. If it is not worth recording it is not worth keeping. If it is worth keeping, it is worth being identified by a complete record.

2. Circulation

Of the various processes amenable to the use of data processing equipment, a circulation control system has been one of the most successful. It is less complex than some of the other areas and can provide much needed data as soon as it becomes operational. Libraries, especially academic, special, and research, recognize the importance of knowing "Who has what." Most automated circulation systems can provide this information along with other data and statistics which have proved valuable in planning and in the day-to-day operations.

A fundamental consideration here is the nature of circulation and the contribution which an automated system can make in improving the efficiency of library services.

Circulation has been described as an unproductive, expensive, nonintellectual, and tedious chore that libraries engage in to keep under control a small percentage of the borrowing population who do not feel compelled to follow the borrowing rules of the library. For this tedious and thankless chore, which does little to improve the collection or to endear the library to the patrons, libraries have been spending hundreds of millions of dollars each year.

In 1955 Goldhor estimated that it cost five cents to charge or discharge a book in a public library (50) and seven to nine cents have been reported for large academic libraries. With today's higher costs a range of eight to ten cents is not exaggerated. As a matter of fact, estimates as high as one dollar a transaction are on record. The 1968 Bowker Annual reports the total circulation in public libraries at an estimated one billion volumes (19, p.22). At the conservative estimate of eight cents a volume to charge out and another eight cents to charge in, circulation is costing public libraries some $160 million dollars each year. Add to this the costs in academic and special libraries, and the figure could conceivably be $250 million dollars. Since most of the cost studies do not include items such as fringe benefits and overhead, which could add another 50 per cent, the total annual figure could easily exceed $300 million. Is it any wonder that libraries are taking their circulation procedures so seriously.

Most circulation systems now in existence are of the type that do not contribute much more than charging books in and out. Libraries having automated circulation systems have not only improved their service at the desk but have easy access to facts and statistics that were not available before. They can now tell "Who has what." They can study the use of the collection and the patterns of usage, helpful for acquisitions and weeding. They can know their patrons better--who they are, what they do, where they come from, etc. They can obtain figures on volume of circulation by hours of the day, days of the week, months of the year--all helpful statistics for scheduling and staffing the circulation desks. They can check for overdues, send notices, and handle fines. Almost all of these facts and figures are essentially by-products of the regular routine of charging and discharging of materials.

Although figures are not obtainable for all automated circulation systems, experiences of a few lead one to believe that most operating systems cannot as yet be justified on purely economic grounds.

In fact, they may cost considerably more than the system they replaced. The justification, however, is found in improved services and valuable operating data obtained at very little extra time and cost.

Almost without exception present automated circulation systems require the use of a punched (machine-readable) identification badge or card for the borrower and a punched book card for each book. The library must decide how the machine-readable book cards will be made. In some libraries book cards have been by-products of another operation. For those not able to obtain the cards as a by-product, the decision is between producing book cards for the entire existing collection before the system is installed, such as at the University of Southern Illinois (36), or partial conversion. For partial conversion, cards are usually prepared for the most-used classes prior to installation and then cards for other books are prepared the first time they circulate after the system becomes operational. In either case, book cards for all new materials are prepared during processing.

As with any automated system or subsystem, the library must be prepared to operate a dual system during changeover. It also must provide for back-up in the event of equipment failure.

The IBM 357 Data Collection System has been the most-used equipment for circulation control, accepting the punched book card and the punched borrower badge to produce one or two punched transaction cards for use in computer or unit record processing. Instead of the IBM 357, which is not an online device, some libraries are using the IBM 1030, which uses the same kind of book card and the same kind of ID badge, operated either offline or online.

Other libraries are using different kinds of equipment such as the Friden Collectadata, also requiring the book card and badge but producing the transaction record on punched paper tape; or the Standard Register Source Record Punch/Badge Reader, Model 1730, a less costly device that has been found satisfactory for moderate circulation.

The usual practice with all of these methods is to obtain each morning a daily circulation printout, which is kept at the desk for reference throughout the day. A disadvantage for libraries with heavy circulation is the size and unwieldiness of these printouts. For them an online system, whereby the desk attendant is able to charge and discharge direct to the computer-stored records and query these records via a remote-access device, eliminates the need for the printed lists.

One of the most complete analyses of circulation appears in the report, A Survey of Library Automation in Texas--Automated Circulation Control (148). In addition to giving a lucid account of fundamental considerations, various approaches, and the pros and cons, it also describes an operating system (Texas A & M University). Although prepared primarily for academic libraries, the remarks and observations are relevant to all.

J. Library Cooperation

Libraries have been extolling the virtues of cooperation for the last one hundred years, and few would doubt their sincere desire to increase and extend library services. Whether one views these cooperative efforts of the past as praiseworthy or totally inadequate, most agree that cooperation has, of necessity, been limited. Although automation is not the total answer to the considerations that must be taken into account in regard to library cooperation, it does provide the technology to boost cooperative efforts to much higher levels than ever before.

Much of the prodding has come from persons outside libraries, not all of whom may be aware of the complexities of achieving high-level national and international cooperation. However, groups who are studying the information needs of this country may be getting a fairly clear picture of how libraries can best contribute toward meeting these needs. It has been said, not always with subtlety, that if libraries do not fulfill their obligation to society by serving users as users wish to be served, something else will take their place. But even if such an idea had never been suggested, the fact remains that the collective libraries of this country have a magnificent accumulation of the world's knowledge and yet only a small percentage of potential users have access to these collections.

The real and lasting viability of libraries depends on the quality and quantity of their services. The decision of how far libraries are willing to go in offering these services rests with the professional staff of each library.

1. Kinds of Cooperation

Libraries have been working together for years in two areas--technical processing and reference services.

Centralized processing centers, operated with varying degrees of success, have been used by groups of libraries for acquisitions, cataloging, and book preparation.

Interlibrary loans, union catalogs of books and serials holdings, and the mutual honoring of borrower cards are common forms of cooperation in reference services. The teletype machine, first used in a library in the '20's, became a common means of communication among libraries in the '50's. It has proved superior to the telephone because it not only has the necessary speed but also provides a printed record.

These types of cooperation for processing and reference services are expected to continue for many libraries. Some recent network developments incorporate both centralized processing and reference service enrichment into the same system, for example, NELINET (see Section IV.B.) and SUNY Biomedical Communication Network (see Section IV.D.)

Although these systems use different approaches, their ultimate goal is to provide comprehensive services. Compatibility with other systems toward national network involvement also seems to be an implied or stated objective.

Librarians are certainly aware of the fact that no library, not even the Library of Congress, Harvard, or the New York Public, can afford to go it alone. Not only is the small public library likely to go the way of the one-room school, as Parker has predicted (109), but all libraries are under increasing pressure to utilize resources not found within their own walls.

The MARC II format and the MARC records are expected to go a long way toward improving communication among libraries and to assist in centralized processing. Since this aspect of cooperation has been discussed elsewhere, the remainder of this discussion concentrates on the development of networks.

2. Concept of a Bibliographic Network

It must be said first that network development is really just in the beginning stages, and the concept of networks, like library automation, is not always clear. The type discussed here is a bibliographic network, whereby libraries can easily and quickly locate the whereabouts of materials not in their own collections. Teletypewriters do this to a limited extent since any library with a teletype machine can make direct contact with any other library with similar equipment. However, if requesting Library A cannot find the material in Library B, it must then contact Library C, and so on until the desired material is located. Each contact is direct and on a one-to-one basis.

A network, on the other hand, can be constructed with switching centers or referral centers. Automation provides the technology to maintain records stored in machine-readable form in a computer so that libraries can access these data by means of remote, online devices.

Networks can be operated at several levels, and there are many possibilities for their composition. There might be networks existing at six different levels, as Duggan suggests (43)--local, area, state, region, national, international. There might also be networks by types of libraries--public, academic, special, or school; or networks consisting of more than one type.

Suppose, by way of illustration, (although it does not exist at present) that a state decided to set up a network for all types of libraries. To begin development it selected 50 of the "best" libraries in the state to submit their bibliographic records. "Best" includes not only the largest public and academic libraries but special libraries with unusual strength in certain areas and strong school libraries.

These records would be collected and stored in machine-readable form on magnetic discs or data cells which are accessible by remote online devices. Part or all of the bibliographic record of each unique title would be stored (it may not be necessary to have the complete catalog card content), followed by a list of the libraries holding that title. Each participating library, which could be more than the original 50, would have a terminal with which to gain access to the machine-stored records.

If the central center is to serve as a switching center, an inquiry may go something like this: Library A can contact the stored records via remote terminal to find out that Libraries C, F, G, X, and Y have the title. The switching center may have the capability to decide that Library X is closest to Library A and therefore switches A's request to X. All copies are out at Library X so the center switches to Library F, determined to be the next most convenient source; this continues through the list until the requested title is obtained.

If the central center is a referral center, it would tell Library A that Libraries C, F, G, X, and Y have the title; but Library A would have to make its own contacts. Obviously a switching center gives more direct service to the library and the public than a referral center.

Other libraries without terminals might use the facilities of those with terminals by some predetermined arrangement.

Adjoining states might also have similar networks which would enable the first state to go beyond its boundaries. The switching center of one state could connect with the switching center in another state, or a group of states could have a regional switching center. This might eventually build up to national and international levels. There could be switching centers at all levels from local or area to state to regional to national and perhaps international.

Admittedly the above is an over-simplification of a very complex situation. It might, however, be enough to ease the minds of some who may think that in a national bibliographic network all library services would be dispensed by some national agency, such as the Library of Congress and its satellites, and that librarians would be reduced to pushing buttons and operating telecommunication gadgets to make contact with one central storehouse of information. It is certain that those involved in network development have no notion of creating a profession of button pushers.

Occasionally one hears about the eventual possibility of having the contents of the world's literature stored in machine-readable form. It could be--sometime, but that is not a concern of this report.

The kinds of materials secured through a network are not too different from those secured through interlibrary loan except that a network permits easier access by more users to more different sources than is possible under most ordinary interlibrary loan agreements. In both cases borrowing arrangements are not intended to replace or act as a substitute for a local library. It is expected that each library system maintain within its own collection the most-used materials and that only the less-used or unusual or unique are secured elsewhere. Network philosophy implies a strengthening of local libraries so they will have recurrently and frequently used materials as well as easy access to other resources to augment and reinforce local library service.

Studies have established the fact that a relatively small percentage of the collection of most libraries is really active. The remainder is more in the nature of archives. Since space is at a premium and building costs are very high, libraries do consider from time to time the possibility of transferring less-used items to a regional (or area or state) center. Such centers could act as depositories as well as switching centers. Several centers are now in existence that serve as depositories of less-used materials for their member libraries.

Lacy (80) has formulated a hypothesis or "hazarded a guess" that more than 98 per cent of public library needs can be met by a well-selected collection of 25,000 titles, and more than 98 per cent of college library needs can be met by a well-selected collection of 100,000 titles. No guess is made for large research libraries probably because it is a foregone conclusion that large research libraries will continue to be the haven for the less-used but immensely important materials necessary to scholars and researchers. He believes that for most libraries 98-99 per cent of library service will still be given in the traditional way by using the library's own collection.

Meise (97) suggests that a local library can identify that portion of its collection needed to satisfy 99 per cent of its users. The remainder of the collection, possibly as much as 60-70 per cent, could be taken out of the library and perhaps some of it transferred to the regional center. The regional center would do a similar type of weeding, retaining enough to take care of 99 per cent of its requests and relying on a national center, e.g., Library of Congress, to handle the remaining 1 per cent. For example, of 100,000 users, 99,000 could be served by local libraries, 990 by the regional center, and 10 by the national agency.

It is believed that most librarians would be very pleased if some arrangements could be made whereby they could retain a degree of individuality and independence and still reap the benefits of extensive library cooperation. A system of networks seems to be the best means yet known to make this possible.

3. Requirements

Whereas libraries of the past were handicapped by the lack of supporting equipment to handle the burden of extensive cooperation, libraries of the present and future are blessed with abundant technology but faced with some basic considerations that must be attacked with more dedication, desire, and enthusiasm than has been exhibited in the past.

The thought of having the world's knowledge available to everyone by a system of networks causes genuine excitement among those who believe such a happening is both possible and probable. They envision a world-wide information and communication system consisting of libraries, information centers, publishers, and other originators and handlers of information and supported by advanced computer and telecommunication technology. Obviously there is a great deal of work to be done before that goal is reached.

To prepare for such a gigantic endeavor, libraries must first convince themselves that cooperation of such magnitude is the proper target to pursue. Actually we do not know whether such a massive communication system will ever be practical or whether people will use such a service if available. Nevertheless, considering our ability to accomplish and considering the steps that must be taken to develop network systems that we now believe to be practical and needed by patrons, it does not seem unrealistic to envision a national or international system as an eventual target, contingent on what is learned and what takes place in the decades ahead.

As each network develops, at whatever level, it must be planned in a thorough and orderly manner. Duggan's article, referred to earlier, "Library Network Analysis and Planning (LIB-NAT)" (43) identifies twelve critical components essential to the orderly, planned development of the network under consideration for the State of Texas. Since these components are similar to those expressed by others, they are stated in full:

"1) Organizational structure that provides for fiscal and legal responsibility, planning, and policy formulation. It must require commitment, operational agreement and common purpose.

2) Collaborative development of resources, including provision for cooperative acquisition of rare and research material and for strengthening local resources for recurrently used material. The development of multi-media resources is essential.

3) Identification of nodes that provide for designation of role specialization as well as for geographic configuration.

4) Identification of primary patron groups and provision for assignment of responsibility for library service to all citizens within the network.

5) Identification of levels of service that provide for basic needs of patron groups as well as special needs, and distribution of each service type among the nodes. There must be provision for "referral" as well as "relay" and for "document" as well as "information" transfer.

6) Establishment of a bi-directional communication system that provides "conversational mode" format and is designed to carry the desired message/document load at each level of operation.

7) Common standard message codes that provide for understanding among the nodes on the network.

8) A central bibliographic record that provides for location of needed items within the network.

9) Switching capability that provides for interfacing with other networks and determines the optimum communication path within the network.

10) Selective criteria of network function, i.e., guidelines of what is to be placed on the network.

11) Evaluation criteria and procedures to provide feedback from users and operators and means for network evaluation and modification to meet specified operational utility.

12) Training programs to provide instruction to users and operators of the system, including instruction in policy and procedures."

Becker (10) stresses the need for formal organization, adequate provision for communication, bi-directional operation, and directory and switching capability. He points out that a workable plan must have a flexible framework rather than a rigid blueprint, and that the Federal Government must lend assistance by making multi-purpose arteries available, even though organized intercommunication will develop from the lower levels, e.g., local, area, state.

Becker also states that criteria need to be formulated to determine what to place in the network, to clarify rules of participation, to agree on network organization and operation, to adopt standards for communication and other common practices, and to investigate the implications of information system integration from social, legal, financial, and technical aspects.

Although networks are relatively new, Connor in 1966 (28) gave ten guidelines for developing reference service: a sound system structure with a legal basis, strong central library resources, well-trained staff, adequate financing, participation of all types of libraries, flexibility, big systems, a strong state library, utilization of the new technology, and continuing evaluation.

4. Realities of Cooperation

Ten years ago Esterquest discussed the "realities" of cooperation (45). Although times have changed and networks rather than interlibrary loans are under discussion, the ingredients of proper planning, intelligent leadership and management, money, staffing, space, and adequate equipment have become more necessary than before.

Common goals must be identified and communicated to all members. Adequate financial arrangements are extremely important. Some libraries will lend more than they borrow, and these libraries must be adequately reimbursed for their services. Most libraries, however, will undoubtedly borrow more than they lend.

A later article by Esterquest (46), although written about the implications for a medical library becoming a Regional Medical Library, makes several points that are generally appropriate for libraries called on to be lenders: First, the possible conflict of interest between local clientele and regional clientele; who has priority for the single copy?; second, the indirect costs to the lending library in servicing requests (postage, packaging, space, heat, light, staff time) and the indirect costs related to the library's investment in its collection, the catalogs, binding, shelving, etc.; third, the hazard of depressing the quality of smaller libraries within the system; fourth, the complexities of territory definition.

As networks develop, cooperation will not be limited to lending and borrowing books but will include, as it does now in some cases, journal articles, technical reports, and other materials that will not leave the library but will be copied and forwarded. Some arrangement must be made to pay for copy services.

Facsimile transmission has been tried in several pilot projects, such as Berkeley Campus to Davis Campus of the University of California (130), University of Nevada (99, 100) and New York State. None was very successful and the cost was excessive; but again, as equipment is improved in quality and reduced in price, facsimile transmission will surely be more attractive to libraries. One disadvantage of present equipment (aside from cost, poor quality, and lack of interest on the part of patrons) is its inability to handle bound material; each page must be photocopied before it can be transmitted. A state-of-the-art report by Schatz (129) examines this technique in detail.

Extensive copying always brings up the question of copyrights, yet to be resolved. Copyrights as well as the financial aspects of cooperation are two very serious problems to be faced in connection with network development.

Library cooperation is being advanced at the national level in several ways such as the cooperative efforts among the three National Libraries, shared cataloging, and the format for bibliographic information interchange proposed by the United States of America Standards Institute, i.e., MARC II format (152).

Cooperation is a topic of interest to libraries of all types and is being discussed from the local to the national level. The entire issue of Library Quarterly for January 1969, "Library Networks: Promise and Performance" reports the proceedings of a conference held at the University of Chicago Graduate Library School in July 1968.

The advances in telecommunications, as dramatic as those in computer technology, provide additional impetus to cooperative efforts. In "Telecommunications Primer" (11) Beiker describes modern telecommunications devices useful to libraries and states that future library communication systems will eventually need to integrate audio, digital, and video signals into a single system.

An article by Bregzis, "Library Networks of the Future," provides some insight into what may be expected in the years to come (20).

Standardization is of utmost importance for extensive intercommunication regardless of the part automated techniques may take in this complex undertaking. Library cooperation touches not only the human, economic, and administrative aspects of libraries; but it may also affect policies of materials selection and library organization.

The willingness of librarians "to give a little to get a lot" will be a very important factor in determining the success of centralized and network activities. Although the ultimate potential for high-level library service is some years away, it is hoped that this potential can be partially realized in the near future. Of one thing all are certain--network development cannot be an unorganized, informal, haphazard, half-hearted venture. A successful network requires cooperation in the best sense of the word.

K. Need for Guidelines, Criteria, and Theory

There are a great many bits and pieces about library automation that need to be sorted out, brought together, and made into some kind of formal structure. There is a need for guidelines and criteria now. Eventually there should be some theoretical base, but perhaps this is too much to expect when librarianship itself seems to lack accepted theory, as noted by Shera (134), Petrof (114), and others.

With so much reference to standardization and uniformity in connection with automated activities, library administrators and their professional staff quite understandably have an inherent uneasiness even though they are willing to accept automation in their libraries. They do not want to lose their individual identities and unique qualities. They do not want their libraries to be carbon copies of other libraries, nor do they want to dehumanize their institutions. Some acceptable balance must be arrived at between uniformity and standardization on the one hand and uniqueness, individuality, and flexibility on the other, so that it is possible for a library to accept uniformity of records and communication media without sacrificing completely its individual identity.

Similarities versus differences among libraries has been of real concern while gathering data for this report. Jolliffe's paper, "Why Libraries Differ--and Need They?" (70) discusses this topic in considerable detail. Near the close of the paper he expresses an opinion shared by others, "It is probable that libraries could benefit users by standardizing some aspects, which could perhaps be identified by research, but we suggest that the variety that exists at present, great though it is, is insufficient for the full satisfaction of users, or more correctly, that it is the wrong kind of variety, in that library practices have been too much constrained by physical and external elements and too little by user needs."

The patron, of course, may not be aware of what occurs behind the scenes or what external forces are instrumental in curbing services he desires; but the differences among libraries that he is able to observe seem superficial and parochial. If he uses more than one library regularly, he may wonder why the same book is cataloged in a different way and shelved in a different section and why circulation routines vary from library to library. The complexity of catalogs, both in arrangement and in form of entry, confuse many library patrons who, with some justification, are convinced the catalog is more for librarians than for them. It sometimes seems that libraries go to extraordinary lengths to be different in areas of little concern to users; few users care how a book is cataloged as long as they can find it. But the user is concerned and cannot understand why it takes three, six, nine, or more months before a recent publication appears on the shelf and why, when a book is out, the library is unable to tell him when it will be returned.

Unfortunately, as Jolliffe suggests, too many libraries seem to be preoccupied with physical and external paraphernalia. They are not giving sufficient attention to user needs and unfortunately are not conveying satisfactorily to their patrons the meaningful differences among libraries--the social responsibilities which may be somewhat different in each library and which are reflected in the kinds of services the library renders to its patrons.

Librarians and libraries are in need of assistance, both practical and theoretical. They need guidelines that are not rigid but that offer choices from which decisions can be made. They need to know what can be expected if one set of variables exists and what different results will be obtained if changes are made. Mathematical models are helpful and are beginning to be used in libraries. As stated before, it is hoped that this type of approach along with other planning and development tools will be used more and more to provide a foundation for guidelines, criteria, and eventually a theoretical base.

Practical guidelines can be developed by accumulating actual experiences in libraries and research results emanating from libraries and library schools because no one report or project or library can provide all the necessary answers. Some data thought to be helpful to other libraries appear in this report. Ongoing projects are of little value to others unless the reporting attempts to be truthful, giving both favorable and unfavorable experiences and factual information of a general nature. For example, one Nelson report on the public libraries of the State of New York (104, p.3) includes in its major findings the fact that the processing of 100,000 items per year was the most uneconomic operation and that the cost per item tends to decrease with fewer items or with more items up to 400,000. Since this is only one study, it is not sufficient to make a rule but combined with other, similar studies, it can serve as the basis for a generalizable conclusion regarding per item processing costs.

Since automation is most efficient when processing standardized or uniform data, it would be of help to know how best to handle exceptions--whether to incorporate them completely into the automated routines, to handle them separately by manual methods, or to process them by a workable combination of manual-machine methods. Costs should, of course, be an important contributing factor in making final decisions.

From the collection of practical and informal guidelines based on experiences and research, more formal criteria and perhaps a theoretical base can be established. These, however, are too complex and far reaching to be left to hit-and-miss methods. It would seem that a formalized framework of any kind should be developed by the teamwork efforts of the professional organizations, the libraries, and the library schools. Development of the MARC II format is an example of the kind of approach which can be used to formulate criteria for library automation that will have stature, substance, recognition, and utility throughout librarianship.

Sensible norms and performance goals can assist libraries to make value judgments. The development of criteria and theory must be a disciplined assignment directed to a main objective and devoid of sideshows and excessive gadgetry which detract from the meaningful goals to be reached.

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SECTION VI - OTHER IMPLICATIONS*

The first five sections of this report have been concerned with the use of data processing equipment in libraries and its implications--implications for the library as an institution and for the furtherance of cooperation among libraries.

Obviously a technology of such potency and potential is also bound to have its effect on the educational programs of library schools, on the research efforts of both schools and libraries, and on the profession itself.

A. The Education of Librarians

More and more library schools are including courses in data processing, library automation, information systems, etc. in their curricula; some are introducing students to the actual use of the computer, and a few are using computer-assisted instruction. Hayes reported in 1967 on the status of data processing and information systems programs in library schools (4, p. 664). It is interesting to note that universities such as Lehigh and Georgia Institute of Technology, which do not have library schools, also have programs of this type.

At this time specific courses vary widely in content and scope. Because of the shortage of qualified faculty, many of these courses have, of necessity, been developed around the qualifications and interests of individuals selected to teach them rather than each course's value as an inherent part of library education. However, in the absence of criteria to determine what should and should not be included in these courses to reinforce curricula, a situation of this type may exist for some time in many library schools--at least until more concerted efforts are made to formulate basic guidelines.

Some library schools have been more fortunate than others in having computer facilities and computer expertise available to them. The Center for Documentation and Communication Research, School of Library Science, Case Western Reserve University is believed to be the first to have a computer (1961) and one of the first to introduce formal courses in library automation and information retrieval systems in its curriculum. Since then other library schools, e.g., California, Illinois, Missouri, Pittsburgh, have established special research centers to enhance their educational programs. Many library schools now have access to computers so that the use of computers can no longer be considered a novelty in library education. In spite of this trend, however, those responsible for these programs are still struggling with the problem of how best to handle computer technology in a library school curriculum.

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* References for Section VI appear at the end of Section VI.

The Library Education Experimental Project (LEEP) of the School of Library Science, Syracuse University, is an example of an extensive effort to use the computer and its products in courses other than data processing and information science. Specific class assignments using the MARC tapes manipulated in various ways have been given in such courses as introductory reference, introductory cataloging and classification, advanced cataloging, technical services, information systems in libraries, and subject reference. Orientation seminars and training sessions have been held for anyone interested, and assistance has been given to individuals as requested. In this project students and faculty have an opportunity to acquire practical experience. They gain insight into computer technology and into possible uses for machine-readable bibliographic data. Because LEEP is funded by a grant, its funds are limited and its future is uncertain; but the data collected and the lessons learned have made a solid contribution to library education and are certain to be of interest to other schools. Atherton and Wyman's "Searching MARC Project Tapes using IBM/Document Processing System," gives additional details (1), and the Newsletter reports current activities (7).

At least two library schools (there may be more) are using computer-assisted instruction (CAI). The University of Michigan is using CAI in the education of reference librarians (11). The University of California, Berkeley is using it in a laboratory for doctoral students, and materials have been prepared for subject cataloging (10). The value of CAI or any other mechanism whereby students may instruct themselves is determined by the quality and extent of coverage of the instructional materials developed rather than the specific mechanism used by students to gain access to these materials. Although CAI has great possibilities, thus far it must be considered experimental and expensive. Probably the greatest task facing library educators in this connection is the development of meaningful content for self-instruction programs.

Partly as a result of automation, some library schools have introduced sixth-year programs and have expanded offerings at the doctoral level; several others have such programs under consideration.

The computer is not only causing changes in the regular curricula of library schools, it is also at least partially responsible for an increase in programs of continuing education sponsored by library schools, libraries, professional groups, and government agencies. Continuing education is one of the best means to keep those in the field informed of what is going on and also to give instruction in new areas. Although these programs have not been as prevalent as many would like or organized according to any master plan, the ones that have been given seem to have been well accepted. Certainly they have succeeded in attracting participants. How effective they are in motivating those who attend is more difficult to judge; but it is thought that most seminars, institutes, and other short courses have accomplished quite satisfactorily what they have set out to do. At the present time the MARC Institutes and the USOE Institutes are the largest programs in continuing education for librarians. For a long-range program the success of continuing education, just as the success of formal curricula, should have some philosophy on which to build. The need for such a philosophy is expressed in Brodman's "Thoughts on a Philosophy of Continuing Education" (2).

Library schools and their educational programs have been subjected to considerable criticism. They have been accused of stressing the "how" instead of the "why" by some, and of not stressing the "how" enough by others; of being unmindful of the needs of libraries, of lagging behind libraries in innovation, of poor teaching, and so on. Undoubtedly these are all true to some extent, but many library schools recognize their shortcomings and are making an effort to take corrective measures. Just as important is the need to improve the poor working relationship that seems to exist between far too many libraries and library schools. This is a responsibility for both sides.

Whatever subject matter finds its way into the specific content of courses should be predicated on the fact that we must include preparation for an uncertain future. In "The Librarian and the Scientist," Lasslo states that "Courses, therefore, should not be overly custom-tailored to fit immediate needs but should constitute individual bricks of dependable intellectual construction materials. The graduates should find them useful in building, and later in reinforcing, their technical resources for an effective career, even if they should find themselves confronted with trends in their profession which were unforeseen at the time of their formal studies" (6, p. 143).

We are educating librarians for tomorrow as well as for today, and our responsibilities lie with those in the field as well as those now in school and those yet to come. Curricula and programs, whether for those seeking a degree or those already in the profession, must be dynamic, flexible, and well composed to meet that uncertain future. Eventually, and hopefully reasonably soon, professional groups would be wise to take some action toward developing at least broad guidelines for educational programs in data processing and information systems. These guidelines should not be structured into rigid patterns that require every school to fit into the same mold and leave no room for innovation and creativity. Rather they should suggest minimal criteria and course content to assist each school in judging its own offerings and prescribing its own future direction.

B. Research

Research, an intrinsic part of innovation and progress, has increased in some areas of librarianship within the last ten years. Both library schools and large libraries have become more active than in the past. Much of it can be attributed to automation.

Project INTREX, the work of the Institute of Library Research at the University of California, and the work of the national libraries are all large-scale research efforts. Yale University is making studies of the use of the catalog and bibliographic retrieval (8,9,12). Stanford University, the University of Chicago, and Columbia University are engaged in large programs within their own institutions and are also cooperating in the exchange of ideas and data.

In spite of these efforts and others of lesser size, much more research needs to be done. We need better techniques for organizing files; advanced studies on handling bibliographic data in machine-readable form; studies on cost accounting methods, cost-benefit analyses, additional areas amenable to standardization, norms and performance goals, evaluation methods. We need criteria for budget justification; comparative studies of hardware and software; additional studies about the library patron; and many others. We need suitable instructional materials and better criteria for the development of long-range plans for the use of computers.

Only a few libraries have the facilities to carry on research projects of this type, and those that do conduct research often, of necessity, must relate it to their own institutions and special problems. For the most part, therefore, the basic and generalizable research should become a prime responsibility of library schools with the active support of libraries of all types and sizes.

C. The Profession

Throughout this report librarianship has been regarded as a profession, not because librarians consider it as such, but because of the belief that it can be an unquestioned profession if librarians will strive to make it so. Bundy and Wasserman's long and introspective article, "Professionalism Reconsidered" (3) discusses librarianship as a profession in terms of three key relationships--client, organizational, and professional. In their words, "Viewed against the perspective of history, librarianship can be seen to have made only slow and gradual evolution as a profession and exists now as only a marginal entry in the competitive race for professional status. The conditions of modern times, however, are such that if librarianship does not move much more rapidly forward toward enhanced professionalism, the field will not only decline rapidly, but ultimately face obsolescence." And two sentences later, "Progress in librarianship is made by only a relatively small number. Innovation remains on trial when it should be encouraged. The field stands conservatively and deeply rooted in the past at a time when such a stance exposes it to danger."

Every librarian is advised to read this article; but it is a reasonable assumption that many have not and probably will not, one reason being that it appears in College & Research Libraries, a journal "not in my field" for public, special, and school librarians.

Whatever the problems in librarianship, they cannot be blamed on the use of data processing equipment in libraries. Automation is not the cause; it might be considered one of the effects. Perhaps one contribution that automation has made is to reveal more clearly than before some chinks in the foundation of librarianship that are badly in need of repair.

At this time librarianship offers what appears to be an unlimited number of challenges to its members--challenges to determine what needs to be done and what can be done to improve and expand the process of information transfer and intercommunications, and challenges to use a high level of discrimination in the selection and retention of old and established practices and in the adoption of techniques from the new technologies.

It was stated early in this report that it is doubtful whether automation can succeed if only a handful of library leaders and innovators are responsible for its destiny. The consensus among those now actively involved is that automation can take its rightful place in the practice of librarianship only when it becomes the responsibility and concern of everyone in the profession. Aside from the fact that librarians need to become knowledgeable in the technology in order to judge its value, they also might profit from a review of some present practices which tend to handicap progress.

Although it is not the purpose of this report to dwell on the shortcomings of librarianship, there are several rather deeply entrenched practices that are disquieting to many responsible and concerned librarians and are mentioned here because they could have a definite effect on the progress of both automation and cooperation in libraries.

1. The ingrown communication system that seems to exist within the community of librarians

Rarely do librarians meet or communicate formally with those outside the profession. They invite "outsiders" to speak at their conventions and listen to what others think about them. But it is unusual for a librarian to go before another group to explain his profession. Librarians have more to offer than most people realize, but until they become more articulate, the public's image of librarians will be slow to change.

Perhaps even more disturbing to interested observers is that each type of librarian--academic, public, school, special--speaks to his own kind, meets with his own kind, cooperates with his own kind, and reads journals for his own kind. Few seem interested in crossing these barriers except when absolutely necessary. Librarians have been extremely successful in emphasizing their differences to the point where they sometimes act as though each group represents a separate profession. Because of these fragments and segments, members may well be losing more than they are gaining by not communicating more intensively and extensively with each other to exchange ideas and opinions.

References for this report were selected with the idea that most of them will be of interest to more than one type of librarian; but it is not at all certain that public librarians will read what medical librarians have to say, that academic librarians will read about special libraries, and so on.

2. Intramural Dissatisfaction

Each of us is guilty of complaining to our peers of problems about which they can do nothing except lend a sympathetic ear. Misery loves company and usually finds a willing audience, but the energy expended in such worthless endeavors might better be spent in seeking solutions to these problems. For example, library funding is a common problem. Reference has been made several times to the need for libraries to strengthen their positions when seeking funds by presenting facts, not superficial notions to those with the authority to act on the matter.

3. Reverence for the Past at the Expense of the Present and Future

Some librarians seem reluctant to give up past practices regardless of their relevancy to today's needs. Those of the past who have earned a place in library history were endowed with a great deal of foresight, and their achievements contributed to library progress. What they did was appropriate for their time and in many cases is appropriate today. If they were here today, however, they would be among the first to make changes wherever necessary. These individuals should continue to be revered for their wisdom and accomplishments; but if precisely what they did is no longer appropriate, their contribution should become an item of library history.

4. Need for Intelligent, Talented People

Perhaps one statement that really sets a person back on his heels is to hear a speaker plead for intelligent and talented persons in librarianship. For sure, the statement should read, "More intelligent and talented people." Otherwise it implies that present librarians are not intelligent, and this is not true.

The contention here is that there are three rather distinct and identifiable groups of librarians. First, there is a large body (but not large enough) of talented and highly motivated librarians who recognize the responsibilities of their profession. These people are willing to take risks, to try new techniques, and to use whatever means are necessary to fulfill their obligations. Like a superior student in a poor school, they make progress regardless of circumstances and their immediate environment.

Second, there is a body of individuals who prefer not to be disturbed; hopefully this group is smaller than most seem to think it is.

The third and largest body of librarians, which includes many younger members, falls between these two groups. These individuals are at present underemployed or overeducated, depending on the way one looks at the problem; but with proper leadership and motivation they could be brought into the mainstream of activity over and beyond the daily routines they are now assigned. The effective utilization of existing talent is most important for the future of libraries. This idea is well expressed in a quotation from an article by Jennings; "Like all institutions, the library is effective to the extent that the true professionals are able to win out against the drones" (5, p. 535).

The qualifications we seek in librarians and prospective librarians are little different from the qualifications sought by every other profession--well-above average intelligence, enthusiasm, dedication, initiative, insight, flexibility, a sense of responsibility, and willingness to tackle complex problems. It is the profession's responsibility to utilize these qualifications to the best advantage.

The demands imposed by the library's changing role, by the introduction of automation, and by the need for further cooperation emphasize more than ever before the importance of using talent properly and of strengthening the profession's leadership and its esprit de corps.

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SECTION VII - CONCLUSIONS*

For libraries this is probably the most complicated period in modern history. The library's role as a social institution is changing and must continue to change from that of a passive custodian of the world's knowledge to an active and dynamic agent with a greatly expanded program of library services. The use of computer technology represents only one segment of the library's effort to meet its obligations and to handle the demands being placed upon it.

Opportunities for advancement have never been better for libraries and librarians, but conversely their problems have probably never been more serious. Along with computer technology has come the opportunity to make the world's knowledge readily accessible to all library patrons and to reinforce library services to a degree never before possible. At the same time these opportunities make it necessary for libraries to reevaluate their objectives and to look again at their sources of funds, their costs, their staffing and personnel practices, their administrative and organizational structure, and their relations with each other.

The threat to the future of libraries is real, but it is not inevitable. For that reason this report closes on an optimistic note in the belief that libraries are capable of meeting their challenges and that they will survive as enriched institutions.

There are many forces at work that bode well for the future of libraries. Activities at the National level are having and will continue to have a marked effect on all libraries, large and small. The work of the state libraries and the consortia of colleges and universities indicate a willingness at those levels to participate in [illegible] expanded program of library services.

Establishment of the National Advisory Commission on Libraries was a landmark in library history. It was formed to study and appraise the nation's libraries in order to determine the most effective way to meet user needs at every level of society. This Commission issued a report, "Library Services for the Nation's Needs," which was circulated and also now appears, along with the background study materials, in a recently published book, _Libraries at Large: Tradition, Innovation, and the National Interest_ (1).

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* References for Section VII appear at the end of Section VII.

Two bills before Congress, if enacted, will become powerful forces toward coordinating library and information services in this country. H. R. 8839 would establish a permanent and independent National Commission on Libraries and Information Science to develop plans for library networks capable of meeting research, recreational, and educational needs and to serve as a principal center for basic and applied multidisciplinary research. H. R. 8809 would provide for a national science research data processing and information retrieval system. Although these bills are still pending, they are indicative of the attention being given to finding solutions for the nation's information problems.

The work of the Library of Congress, the National Library of Medicine, and the National Agricultural Library is already reaching local libraries with MARC tapes, MEDLARS, the Regional Medical Library Program, and the work of the National Libraries Task Force.

Particularly encouraging to librarians is the fact that libraries are finally being recognized as a constituent part of a large information transfer and communication system and the fact that the need for better services is recognized on the National level.

While national agencies may provide the wherewithal to bolster the services of libraries and other centers that serve the nation's needs for information, much of the actual implementation will take place at the local, area, and state level. The need for superior performance by librarians has never been greater.

The fact that the use of computers is surviving and growing in libraries is only one indication of this need for improving library services. Not only is automation necessary for maintaining the present level of services but even more for handling new needs yet to come. These needs are not static objects that stand still and wait patiently for attention. They are constantly emerging and changing. Libraries will not have fulfilled their total obligation to society until such time as each library can serve each patron in its community completely.

There is much to be done that only librarians themselves can do. It has been suggested that librarians spend less time on techniques for getting things done and more time on analyzing what needs to be done and what more can be done. There is a continuing need for strong leadership, more talent and better utilization of presently available talent, and in some cases a change of attitude and a fresh point of view.

Regardless of what happens at the national or state level, it is expected that librarians will continue to operate the libraries of this nation. They will continue to work in library buildings that may not look much different than they do today. The differences lie in the range of services offered and the media used to store the world's knowledge.

Until World War II most of the recorded knowledge of the world was printed on pages, bound between two covers, and called a "book". Within libraries the book became the basis for formulating selection policies, processing techniques, and rules for circulation and reference services. Other materials--serials, reports, manuscripts, maps, music--often received only secondary attention since books were considered the foundation of a library collection.

Within the past twenty-five years these nonbook materials, especially serials and reports, have become increasingly important in all libraries; and for many special libraries they are now the primary sources of current information. Libraries are also beginning to acquire newer forms of recorded media--recordings; AV materials; films; microrecords in the form of microfiche, microcards, film strips, and reels; and more recently, machine-readable data bases for computer processing.

For most libraries these nonbook media have not yet posed a major problem; but for research, academic, and special libraries they are becoming an important part of the total collection. Only recently has there been much of an attempt to establish processing routines that can handle these nonbook materials as part of the normal flow of work. The MARC II format has been constructed so that it can be used for media other than monographs.

No one probably know how much impact these newer forms will have on library collections as a whole. Some predict that a large part of the collections of some libraries may be in microform. Although this medium has been somewhat disappointing, the technology is improving rapidly and has been found satisfactory for newspaper files, dissertations, out-of-print documents, and materials difficult for many libraries to acquire in regularly printed form. It is conceivable that, in addition to the bibliographic records, indexes, and abstracts already used by some libraries, other materials will eventually be available in machine-readable form.

The form in which the world's knowledge or information about the world's knowledge is contained or packaged should not be the principal concern of librarians. They, of course, must be concerned with how to process it, control it, store it, and maintain it; but their chief concern should be the contents and their uses rather than the physical form. Whether the patron's needs are served and satisfied by a book, a journal article, a tape recording, a film, a scroll, a picture, a microform, a computer terminal, or a cathode-ray tube should not be an unduly traumatic experience to librarians unless they have been so preoccupied with the physical construction of the book that they have neglected to take into account its real purpose.

Because libraries of the future will undoubtedly store the world's knowledge as printed records, microrecords, voice records, visual records, and digital records, it is hoped that librarians of the future will accept these forms as legitimate means for information transfer.

The role of the library can be viewed at three levels: as a single system serving the needs of its patrons; as an involved member of a library network or a system of networks to which it will contribute its resources and from which it will reinforce its own resources; and last but by no means least, as a member of the community of all libraries which are part of a much larger information transfer system involving not only libraries but also information centers, publishers, other social institutions, professional societies, and perhaps even governments.

The library of the future is envisioned as having librarians rendering extensive custom-tailored services because they have the technology and the resultant capability to retrieve, by means of man-machine interaction and vast information transfer networks, selected segments of the world's knowledge recorded in a multiplicity of media. Somehow this does not seem as impossible or unreasonable as it did even ten years ago.

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APPENDIX

GLOSSARY

Batch Processing. Items to be processed on the computer are coded and collected into groups or batches to be handled as one job; it would be uneconomical to enter only a few items at a time; e.g., purchase orders accumulated for the week; circulation records for the day, etc.

Central Processing Unit (CPU). This is really the computer; it is that part of the computer system that contains the control functions, the internal storage (main storage), and the arithmetic and logic units.

Hardware. This is the generic term for equipment or machines.

Input. Raw data or information coded and entered into the computer for processing is input data; the medium or device on which the data are recorded e.g, punched card, punched paper tape, magnetic tape, etc. is the input unit.

Offline versus Online. An offline operation is one performed by a piece of equipment which is not under the control of the central processing unit of the computer, e.g., punching cards on a keypunch, punching paper tape on a paper-tape typewriter, merging cards on a collator. None of this equipment is connected to the computer.

An online operation is one performed by a peripheral device which is under the control of the central processing unit of the computer, e.g., accessing the computer via a typewriter terminal, reading the data on punched cards into the computer via the card reader, and printing out data on the computer printer. All computer "input" and "output" devices (I/O units) are online.

Output. Both the product or results of the data that have been processed and the medium or device on which the data are recorded are called output.

Remote Access. This means that a peripheral device can communicate directly (online) with the computer even from some distance away. The device, e.g., typewriter terminal, cathode ray tube (CRT), or a data collection unit, may be located as much as thousands of miles away. This peripheral device is under the control of the central processing unit and is connected by special cables or telephone lines. Such equipment is now commonly used by airlines, hotels, banks, and wherever instant information is important.

Sequential versus Random Access Storage and Processing. Anything stored on and processed from a reel such as magnetic tape must be done in sequence; the record at the end of a reel cannot be processed without passing all of the others; thus both the storage and processing are called sequential

Random Access (or Direct Access), on the other hand, permits processing a record by direct selection without passing the others. Magnetic disks, magnetic drums, and data cells permit this type of storage and processing. Sequential storage requires arrangement of the records in some predetermined order; random storage is much more flexible.

Software. A set of instructions for manipulating data, performing a routine, or solving a problem is known as a computer program. The generic or collective term for these programs is software.

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ABSTRACT

This report has two main purposes: (1) To give an account of the use of automation in selected libraries throughout the country and in the development of networks, and (2) to discuss some of the "fundamental considerations" relevant to automation and the implications for library education, library research, and the library profession.

The first part of the report traces the development of automation in libraries and discusses in detail the work going on in more than twenty selected libraries. In addition, briefer accounts are given for a number of other libraries and cooperative projects.

The second part is concerned with factors that must be taken into account in planning and developing automated systems and networks and the implications of automation for library education, library research, and the library profession.